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TECHNICAL EDUCATION IN INDIA*

THE role of science in modern world is rather confused. On the one hand, science has evolved atomic power, shining malevolently in its crown, and, on the other, dialectically enough, it has great and lasting achievements in the service of humanity and the development of the arts of peace. For example, in the last Great War science has been utilised to an extent which staggers human imagination in perfecting the weapons of death and destruction. At the same time, it has also made, in the midst of the war, great and valuable contribution in alleviating the miseries of mankind. To give but one example: Medical Science during the War was so fully developed that it was responsible for bringing the Army's death rate from 14.1 per thousand in the last War to 0.6 in this. These are two contradictory manifestations of science which have puzzled men in every generation and clime. The question that naturally arises is, how in the midst of these conflicting ends Science can make its maximum contributions to the welfare of Society. This is impossible without a re-definition of the role of Science in Society.

True Science has little to do with war. The problem is how to break the periodic and death-dealing subversion of Science to war, how to shape the superb instrument, built up out of the finest creative ability of mankind, to the conscious ends of peace.

One way of doing it is to harness the power of science to the material development of nations and thereby raise the standard of living of the people to a much higher level than now. Such development should not be restricted to a few countries, as at present, but should be diffused all over the world. In particular, conditions of living should have to be upgraded beyond recognition among the undeveloped countries, like India and China, which between them contain about half of the world's population. The *sine qua non* of such development is the existence of a large body of specialised knowledge and technical skill. In helping to spread such knowledge and skill among the under-developed countries of the world we would be enabling science to play its beneficent role as opposed to the destructive one which it has so unfortunately played with a periodic repetition.

That the creation of a body of technicians may well be regarded as a condition precedent to swift and rapid economic development is

* Text of an Address by Sir N. N. Sarkar, Chairman of the All-India Council for Technical Education. Delivered at the Council at Bangalore on 20th May 1947.

amply borne out by the history of those countries which have reached a commanding position in the sphere of economic development.

The system of technical education even in Great Britain is being reorganised according to the recommendations of the Percy Committee which expressed the apprehension that the position of Great Britain as a leading industrial nation was being seriously endangered by failure to secure the fullest possible application of science to industry.

Soviet Russia offers an illuminating example of what a nation can achieve in the sphere of economic development by stimulating scientific research and technical education. The implementation of a technical personnel plan was an integral part of the economic plan and was carried on simultaneously with the other parts of the plan, as would be evident from a few figures I am citing presently. At the inception of the first five-year plan the Soviet industry as a whole had at its disposal a staff of technical personnel numbering 58,000. The figure was continuously raised under the successive five-year plans until in 1939 it reached the impressive figure of 9,590,000 out of a total population of 170,000,000.

America and Japan have similarly expanded their technical personnel during the last two or three decades.

Indian scientists have no doubt made brilliant original contributions in a number of branches and achieved world-wide renown. The names of Raman and Bose are outstanding in the older generation, but they have also an ever-increasing number of successors in our own times. The results of their research have also been of considerable aid to Indian industries. Nevertheless, it remains true that these researches have not been fully and properly correlated to the needs of industries due mainly to the deficiency of facilities for technical education in our country. This was fortunately realised by the Government of India in recent years which held the view that the most serious bottleneck to the implementation of a plan of economic development would be the inadequacy of technical personnel, and not finance as is usually believed. This awareness on the part of the Government, of which Sir Ardeshir Dalal was the Planning and Reconstruction Member at the time, led to the formation of an *ad hoc* Committee, consisting of scientists and businessmen, with a view to planning for higher technical education facilities in India. The Committee submitted their interim report recommending the establishment

of not less than four Higher Technical Institutions in different parts of India which would serve as models for scientific and technical education, particularly of a very high order. Of them one will be in the North, one in the East, one in the South and one in the West. The Eastern Institute was to be set up first, in or near Calcutta, while the establishment of the Western Institute, in or near Bombay, should be taken in hand concurrently or failing that as soon after as possible. Calcutta and Bombay were suggested for the location of the Eastern and Western Institutes respectively because of the existence of big industries in these areas. In the meanwhile, the All-India Council for Technical Education was set up by the Government of India with three primary objects in view, viz., (1) to survey the whole field of technical education in India, (2) to consider the desirability of establishing high-grade technical institutions on the lines of the M.I.T., and (3) to promote inter-provincial co-ordination in All-India schemes of technical education. The All-India Council endorsed the recommendation of the *ad hoc* Committee, and the Government also, it is understood, has accepted this recommendation. With a view to achieving co-ordination the Council has also set up six All-India Boards of Technical Studies in Engineering and Technological subjects. These Boards, consisting of experts drawn from all over India, are engaged in drawing up syllabuses of studies and evolving sound methods of teaching and examination.

While recommending the establishment of a few high-grade technical institutions the Council at one stage of its deliberations was confronted with a somewhat different view regarding the advisability of establishing immediately such technical institutions. This view, quite good as it is, states that facilities for technical education should be improved and extended by strengthening the existing institutions and that no new institute should be established without first conducting and completing a detailed survey to ascertain precisely the needs and requirements of industries. As regards the first, I may mention that the question of strengthening the existing technical institutions is bound to engage the serious attention of the Council. The existing basis must receive all the care and attention it deserves, since they are as yet the only means to meet the current demands for technical personnel. As we all know, visiting Committees were appointed by this Council for important technical institutions of every region

with a view to determining the facilities available in these institutions, to ascertain their needs and bring the systems of training to a certain standard. These Committees have submitted their reports and these will be considered at this meeting of the Council, whereupon adequate grants will be recommended by the Council to the Government for distribution among these institutes.

On the question of making a detailed survey with a view to determining the needs of industries, there can, of course, be little controversy. If schemes of extending technical facilities are undertaken without regard to actual needs, facilities may be far in excess of needs and, it is contended, the recruits annually turned out may fail to be absorbed in gainful occupations for lack of commensurate expansion of industries. All this is no doubt true; but when the detailed and comprehensive survey of a vast country must necessarily take some time to be completed, this should not be allowed to prevent a beginning to be made in the direction of providing such facilities. Taking, for example, the case of India it can be pointed out that facilities for technical education in this country are so meagre and insufficient to meet even the existing demands that the establishment of a few technical institutions before the survey is completed can never be regarded as leading to a surfeit of such facilities. The plans of hydroelectric development, road-building projects, irrigation and agricultural improvements and various other plans lying ready in the archives of the Governments, both Central and Provincial, would require a large body of technicians. It has been estimated by a British Engineering Journal that the schemes of water-power development alone would need 20,000 technicians. These are only the needs of Governments in some of their departments. There is also the growing volume of requirements of private industries to be satisfied. All these would clearly show that the establishment of a few technical institutions immediately, as recommended by the Council, can by no means be regarded as creating a condition in which the annual number of recruits trained by these institutes exceeds the annual intake of indus-

tries, even as we can visualise the latter's needs in a rough and ready manner. Further, in a matter which concerns the education and training of individual human beings, adjustments of supply and demand should be made within wide tolerances. While it may be feared that the creation of new technical facilities may lead to unemployment if they are in excess of existing needs, it is equally plausible to argue that in the case of a growing and newly-developing country the presence of these technicians may act as a spur to development, thereby creating their own conditions of work and employment. In the present condition of India, of course, there can be no question of the supply of technicians outrunning demand. In the future scheme of things also the status of technical and managerial personnel will arise, as finance loses some of its dominating role.

I may here refer to a prevailing notion about the import of foreign technical skill and industrial "Know-how" from abroad to meet India's demands. We shall, no doubt, have to depend on foreign assistance in many spheres at the initial stage, since we have at present very little technical force of our own. But the possibility of any large-scale import of foreign technical experts must be ruled out at present, and this for two reasons. In the first place, there are the calls of reconstruction in Europe and elsewhere, and the enormous industrial and governmental undertakings contemplated in Europe and America to provide full employment. Already a shortage is being felt in these countries of high-grade technical personnel and efforts are being made to meet these shortages. It would be difficult, if not impossible, in these conditions, to secure the services of technical personnel from abroad to the extent required by India. Further, whatever services may be available, a tendency has been recently at work for foreign technical experts to demand, apart from extortionate prices, a controlling influence in the concerns for which their services are required. This is all the more reason why India should build up her own higher technical force with the greatest possible expedition.

THE EDITOR, CURRENT SCIENCE

MR. M. SREENIVASAYA, Editor, *Current Science*, left India on the 26th June for an extensive tour of Europe and America. In the course of his tour he will attend the Science Conferences in Sweden, visit important research laboratories, industrial plants and academic in-

stitutions. He also proposes to renew and make fresh contacts with the editors and sponsors of scientific journals in the countries of his visit. During his absence from India Mr. K. S. Rangappa, Assistant Secretary, will look after the duties of *Current Science*.

PRINCIPLES FOR THE CONTROL OF PUBLIC UTILITY ELECTRICITY SUPPLY FINANCE*

THE Advisory Board was constituted by the Government of India to examine the principles for the control of Public Utility Electricity Supply Finance, formulated by the Electrical Commissioner with the Government as to which of them should be adopted and to what extent and in what manner they should be enforced. The principles are to constitute the sixth schedule of the Electricity (Supply) Bill, 1946, and are to be incorporated as an amendment to the Indian Electricity Act, 1910.

The Advisory Board consisted of Mr. H. M. Mathews, Electrical Commissioner with the Government of India (Chairman); Mr. D. L. Mazumdar, Joint Secretary to the Government of India, Department of Works, Mines and Power; Mr. P. B. Advani, Special Officer (Electric Grid), Bombay; Mr. K. V. Karantha, Chief Electrical Inspector to the Government of Madras, and Mr. I. A. Macpherson, nominated by the Federation of Electricity Undertakings in India. The report of the Advisory Board was unanimous in every respect except for a note of dissent by Mr. Macpherson regarding "Standard Rate", mention of which is made in the relevant place.

2. The need for an effective and uniform method of control of Public Utility Electric Supply finance has been keenly felt, owing to the fact that under the existing conditions there are a number of factors which retard the development of the electric supply industry in India. The chief of them are: (i) A large number of small undertakings, the issued Capital of which is under Rs. 5 lakhs, exist, and their development has undoubtedly been impeded by difficulties experienced in raising capital and the high rate of interest demanded for its provision. (ii) The monopolistic character of such undertakings has led to many abuses in the absence of an adequate control. (iii) The amount of financial control which a Provincial Government can exercise under the Indian Electricity Act (1910) is inadequate. (iv) The interests of the consumer often take a second place to those of the shareholder.

The principles were, therefore, devised so as to fulfil the following objects:

- (a) To safeguard the interests of the consumer by limiting interest and dividends payable to shareholders to the minimum necessary to ensure an adequate flow of development capital, and thus effect a reduction in the selling price of electricity.
- (b) To safeguard the interests of investors (and, in the long run, of the consumers as well) by insistence on a properly devised system of compulsory depreciation and at the same time permit the earning of a "reasonable" or "fair" return on the investment.
- (c) To regulate the commission and expenses of Managing Agents within reasonable limits having regard to the special circumstances of the industry.

* A Note on the Report of the Advisory Board on the Principles for the Control of Public Utility Electricity Supply Finance.

The salient features of the principles are as follows:—

CAPITAL BASE

Under these principles the amount allowable as divisible profits will mainly depend on the size of the undertakings' "Capital Base" which is defined as "the depreciated cost of fixed and intangible assets plus working capital but exclusive of goodwill and non-compulsory investments, Debenture and Preference Capital". The Capital Base recommended will permit the various undertakings, who have indulged in the past in the capitalisation of revenue partly at the consumer's expense, to retain the assets thus acquired in the Capital Base. Once the Principles are enforced, however, this practice will automatically cease and when new development capital is required, instead of employing surplus profits, etc., it will be necessary for the undertakings to raise fresh capital from the Public or borrow from other sources.

The relation which the "Capital Base" will bear to the paid-up ordinary share capital will depend on several factors. The "Capital Base" may be greater than the paid-up ordinary share capital in the case of undertakings which have not been prevented from earning an unduly high profit and have been able to capitalize part of this; and conversely may be less for the reason, e.g., the profit and development of the undertaking may have been restricted. The amount in the "Capital Base" represented by the "ploughing back" of undistributed profits prior to the introduction of the principles will signify less and less, and as time goes on, because the tendency will be for the "Capital Base" to approximate more and more to the paid-up ordinary share capital, any excess in the long run being represented by the effects of efficient management.

STANDARD RATE

3. The "yard-stick" which is used to measure what is considered to be a "Reasonable Return" on the "Capital Base" is the "Standard Rate" and the "Standard Rate" is taken to be—in respect of any accounting year the redemption yield of the longest dated terminable loan of the Central Government last issued prior to the last accounting year of the licensee, adjusted to the nearest one-quarter of one per cent., as declared for this purpose at the end of the Government financial year by the Reserve Bank of India to the Central and Provincial Governments, plus

- (i) 3.5 per cent. for the first Rs. 10 lakhs of the Capital Base;
- (ii) 3.0 per cent. for the next Rs. 40 lakhs of the Capital Base; and
- (iii) 2.5 per cent. for the balance of the Capital Base.

4. [Mr. Macpherson recommended in his note of dissent that (i), (ii) and (iii) should be 5.5 per cent., 5 per cent. and 4.5 per cent. respectively.]

"REASONABLE RETURN"

is taken to be—

In respect of any accounting year, the sum of:

- (a) The amount arrived at by applying the standard rate to the Capital Base at the end of that year;

- (b) the income derived from investments other than Contingencies Reserve invested in Trustee securities as defined in the Indian Trust Act; and
- (c) half the difference between the interest payable on debenture capital and such greater amount as would have been payable had the money been borrowed at the "Standard Rate".

An important object of the principles is that the excess of the gross income over allowed expenditure, viz., clear profits, shall not exceed the amount of the Reasonable Return. In view of the fact, however, that it may not always be possible for an undertaking to regulate its financial policy in such a manner that the clear profit does not exceed the reasonable return, when such an excess occurs, it is considered that it should to some extent at least be used to supplement the income of the undertaking in the years when the actual "clear profit" falls below the amount of the reasonable return. With this object in view it is proposed in the principles to create a reserve called Tariffs and Dividends Control Reserve. In those years when the undertakings' clear profit is in excess of the Reasonable Return, one-third of such excess shall be credited to this reserve and those years when the undertakings' clear profit is less than the reasonable return, the undertaking may draw from this reserve to make up their deficiency in whole or in part. It has also been provided for that one-third of the excess shall be used for a rebate to the consumers and the remaining one-third be made available to the undertaking as a bonus for efficient operation. Provision has also been made to prevent undertakings from earning a clear profit constantly in excess of the Reasonable Return permitted, by the provision for a Committee which may be appointed by the Provincial Government to examine the licensee's charges for electricity in accordance with the principles.

REMUNERATION OF MANAGING AGENTS

The remuneration drawn by the Managing Agent covers two separate items; firstly, commission and secondly, an allowance on account of office expenditure.

Commission.—Under the Principles the commission is based on "Clear Profit" instead of "Net Profit" and shall not exceed without the permission of the Provincial Government.

In respect of the first Rs. 5 lakhs of such profit—10 per cent.

In respect of all additional profit—7 per cent.

In view of the fact that in the early years of working, the clear profit of an undertaking may be small and inadequate to provide reasonable remuneration for the Managing Agents, provision has been made for the payment of a minimum amount as Managing Agent's commission based on the total issued capital.

In the absence of or inadequacy of profits the amount paid to a Managing Agent shall be subject to a minimum payment not exceeding two rupees per annum for each complete thousand rupees of paid-up share and debenture capital, provided that for purposes of computing the minimum payment, should the share and debenture capital be less than Rs. 5 lakhs, it shall be taken as Rs. 5 lakhs and

should the said capital be greater than Rs. 1 crore it shall be taken as only Rs. 1 crore.

Office Allowance.—An office allowance drawn by a Managing Agent which includes the salaries and wages of all personnel employed in the office of the Managing Agents with the exception of Engineering staff employed for the purposes of the undertaking is based upon a percentage of the operating expenditure during the year of account on capital works. The office allowance so drawn shall not exceed without the permission of the Provincial Government.

- (i) In respect of the first Rs. 1 lakh of operating expenditure—8 per cent.

In respect of the next Rs. 2 lakhs of the operating expenditure—5 per cent.

In respect of the next Rs. 7 lakhs of operating expenditure—2½ per cent.

In respect of all additional expenditure—1½ per cent.

- (ii) In respect of the first Rs. 1 lakh of capital expenditure incurred during the year of account—4 per cent.

In respect of the next Rs. 2 lakhs of capital expenditure incurred during the year of account—3 per cent.

In respect of the next Rs. 7 lakhs of capital expenditure incurred during the year of account—1½ per cent.

In respect of all additional capital expenditure incurred during the year of account—1 per cent.

As regards the proper application of the provisions of these principles it is stated that the Provincial Governments even now have the authority necessary to effect the required measure of general control, and when statutory electricity supply Boards are set up under the provisions of the proposed Electricity (Supply) Bill they will have the power to effect an adequate and detailed supervision of the accounts of the licensees under their jurisdiction.

For the industrial and agricultural development of the country an abundant supply of electricity at reasonable rates is the first essential; and in the post-war era the cost of electricity will be of great significance in the establishment of efficient and competitive industry. The enormous profits which the shareholders would have enjoyed will be divided, under the principles, between them and the consumers by way of reduced charges. It may be argued that with reduced charges demand will increase, which the licensee may not be able to cope up with the existing plant. This will result in expansion of the industry with a real "Capital Base" and not an artificial inflated one. The principles are not meant to restrict the sale of electricity but the profit on that sale. It can, therefore, confidently be stated that the Principles, by providing an effective and uniform method of control, would contribute in no small measure to the rapid development of the Electric Supply Industry in India.

H. N. RAMACHANDRA RAO.

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THE EFFECT OF SODIUM CHLORIDE IN IMPROVING THE PERMEABILITY OF ALKALI SOILS

By L. A. RAMDAS AND A. K. MALLIK

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THE ascent of an aqueous solution of sodium carbonate through a column of black cotton soil has recently been discussed.¹⁻⁴ It was shown that the capillary rise with a very dilute solution of sodium carbonate is slightly greater than with water, and as the concentration rose the permeability rapidly deteriorated. But when the concentration was further increased (say, 5% to saturation) the permeability was restored owing to the chemical action of the sodium carbonate solution on the colloidal fraction of the soil. These results have been discussed in the *Proceedings of the Indian Academy of Sciences* (Vol. 25, Pt. 6—in Press).

In the present note we shall discuss some interesting results obtained recently on the effect of sodium chloride in restoring the permeability of a column of black cotton soil previously rendered impervious with sodium carbonate solution. The upward and downward movements of sodium chloride solution in the "Bari" (alkali) soil of the Punjab are also discussed.

I. EXPERIMENTS WITH THE BLACK COTTON SOIL OF POONA

(a) *Capillary rise.*—Glass tubes containing air-dry black cotton soil of Poona, passed through a 1 mm. sieve, were dipped in 1 per cent. solution of sodium carbonate till the capillary rise of the solution stopped (i.e., the height of the soil column visibly wetted by the solution ceased to increase further). The tubes were then dipped up to the level already wetted by the sodium carbonate solution in reservoirs containing (1) a 1 per cent. solution of sodium carbonate, (2) a 5 per cent. solution of sodium chloride and (3) water, respectively.

Table I gives the ascent of the two solutions and water through the columns. It will be seen from Table I that the ascent of a 5 per cent. solution of sodium chloride is about four times that of sodium carbonate and twice that of water.

In the next experiment the ability of sodium chloride to improve the permeability of the soil after carbonate treatment was further examined.

(b) *Percolation through soil layers.*—In this experiment the percolation of the three liquids was studied by maintaining 10 cm. layers of the liquids in different tubes containing the soil. First, 10 cm. layers of black cotton soil were packed in three tubes in the usual manner and 1 per cent. solution of sodium carbonate added above the soil column. After seeing that there was hardly any percolation of the sodium carbonate solution even after two days, the solution was removed from two of the tubes and replaced with the same volume of a 5 per cent. solution of sodium chloride in one tube and with water in another, while the third tube served as control.

TABLE I
Capillary ascent in black cotton soil (in cm.)

Time (Days)	First dipped in 1% sodium carbonate solution		
1	3.3	3.3	3.3
2	4.3	4.2	4.3
3	4.3	4.3	4.3
	then dipped in		
	Sodium carbonate 1%	Sodium chloride 5%	Water
1*	0.6	0.9	0.9
2	1.1	1.8	1.5
3	1.5	2.8	1.9
4	1.7	3.6	2.3
5	2.0	4.3	2.5
6	2.2	4.9	2.8
8	2.6	6.1	3.4
10	2.8	7.0	3.7
12	2.9	7.6	3.9
14	2.9	8.1	4.1

The values for percolation are given in Table 2.

TABLE 2
Percolation in c.c.s. through 10 cm. column of Poona soil

Time (Days)	10 cm. column of 1% sodium carbonate		
1	0.0	0.0	0.0
2	0.1	0.1	0.1
	1% sodium carbonate	Solution replaced by 5% sodium chloride	Solution replaced by water
1	2.5	4.0	2.5
2	3.0	14.0	3.5
4	3.0	39.0	4.0
6	4.0	89.0	5.0

It is obvious from Table 2 that sodium chloride restores the permeability of the black cotton soil, previously rendered impervious by sodium carbonate.

II. EXPERIMENT WITH "BARI" (ALKALI) SOIL
OF THE PUNJAB

Next a naturally alkaline soil like the "Bari" soil of the Punjab was similarly tried. This soil is very impervious to water due to the presence of considerable quantities of sodium carbonate and sodium sulphate. Experience showed that care is necessary in packing the "Bari" soil so that breaks in the column do not occur on wetting. This is ensured by loosely packing the soil in the tubes. Tables 3 and 4 give the values for capillary rise in and percolation through the "Bari" soil.

TABLE 3

Capillary rise in "Bari" soil (in cms.)

Time (Hours)	Water	5% Sodium chloride
1	2.4	8.2
2	3.4	14.0
3	4.0	17.2
4	4.4	21.2
22	10.3	46.7
28	11.2	51.3
48	12.7	61.0

It is clear from Tables 3 and 4 that the movement of a 5 per cent. solution of sodium

chloride is much faster than that of water in the "Bari" soil.

TABLE 4

Percolation in c.c.s. through a 10 cm. column of "Bari" soil

Time (Hours)	Water	5% sodium chloride
1	0	0
2	0	1.0
3	0	3.0
21	0	16.5
27	0.5	21.0
48	1.0	48.0
71	2.5	74.5
96	3.0	121.5

The applications of the above findings to the leaching out of the salts from alkali soils are being investigated. Similar experiments with other salts are in progress, and the results will be reported in a later communication.

1. Ramdas, L. A., and Mallik, A. K., *Proc. Ind. Acad. Sci.*, 1942, 16 A, 1. 2. —, *Ibid.*, 1942, 16, 16.
3. — and Pandit, U. P., *Curr. Sci.*, 1942, 11, 288.
4. Ramdas, L. A., and Mallik, A. K., *Curr. Sci.*, 1942, 13, 42-288.

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THE PROCESSING OF MAIZE TO IMPROVE ITS VALUE AS AN
ARTICLE OF HUMAN FOOD

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MAIZE is one of the more important millet crops of India. It is also grown quite extensively in other parts of the world and very large quantities have been imported into India in recent years. It is used as an everyday article of diet in certain parts of the country, while, in other parts, its use is rather unfamiliar or unpopular. Persons accustomed to rice, wheat, tapioca and such other food materials do not like maize because of its hard and fibrous coat, the bitter principle usually associated with the skin and the oil present in its germ. The latter also tends to turn rancid on long storage and renders the grain unpleasant as an article of food.

WHOLE-MAIZE IS NOT POPULAR OVER A LARGE
PART OF THE COUNTRY

During recent years, several attempts have been made by the Central and Provincial Governments and also by the States to popularise the use of maize as an article of food. These efforts have met with only moderate success because the average consumer, say, of rice, prefers to go on a reduced ration of his favourite cereal, rather than have extra food in the form of maize which he does not like and which he finds to be coarse and difficult to digest. This is chiefly due to the fact that the maize is supplied to him either as a whole-grain or as whole-flour (coarsely ground), neither of which he is able to utilise satisfac-

torily. The position will be very different if the grain can be processed to remove the undesirable constituents and then supplied to the public as an article of food.

THE 'AMERICAN FLOUR'

A few decades ago, processed maize flour was introduced into India, the supplies coming chiefly from America. The product soon became very popular so much so that it found application in a variety of food preparations. In South India, it became very popular as 'American flour' and there was a very great demand for it, though only a few people knew what it was made of.

PROCESSED MAIZE PRODUCTS AND THEIR USES

In Europe and America, processed maize flour is finding extensive application. It is the basis for the usual thickeners of soups, breakfast cereals, various types of sweets as well as meat puddings, ice-cream and so forth. Other preparations like spaghetti and macaroni which are also familiar to the Indian consumers are prepared out of maize flour.

Considering all available evidence, it would appear to be extremely important that maize should be first processed and preferably converted into a clean, attractive flour before it could find general, popular favour in India. The husk and the germ can be separated, the former being used as an animal feed, while the latter can be crushed and used for preparing

maize oil which can be used for soap-making and other purposes.

THE EXISTING STARCH FACTORIES CAN BE USED FOR THE PRODUCTION OF PROCESSED MAIZE FOOD

Some years ago, a number of starch factories were started in different parts of the country to meet the increasing demand for starch from textile and other industries. There are now about twenty fair-sized factories in India with a capacity for handling hundreds of tons of maize per day. These factories were working very actively during the war, but, recently they have been thrown mostly out of commission because of the necessity for distribution all available maize as an article of human food. As already mentioned, the results of this change have not been as happy as was originally expected. While the starch factories have been mostly idle, maize is not finding much favour as human food and quite large quantities are perishing in different parts of the country.

A modern starch factory has the necessary equipment for the steeping, efficient removal of the skin, separation of the germ and other processing of maize. These operations form a part of the process connected with starch manufacture. It appears very desirable, therefore, that instead of keeping the starch factories idle, their equipment could be utilised for processing the maize in such a way that they will turn out acceptable articles of human food. It should be possible for an average starch factory to turn out a flour that would exclude the skin and the germ, but include the rest of the grain as a fine flour. This flour would be attractive and can be used for a variety of purposes. There is strong justification for preparing bulk specimens of the finished products and conducting consumer tests with them over different parts of the country.

THE MAIZE GRIT

The above would be a wet method of processing the grain. That would necessitate the drying of the final product. There is also some risk of a part of the maize oil being carried along with the maize gluten which would form

a part of the flour. There are also dry methods which could be used for the removal of the skin and the germ. The remaining part of the grain could be converted into a form which is commercially known as maize grit and which can be used for a variety of purposes. The equipment for the manufacture of maize grit is available and can be easily obtained from abroad. If some maize grit could be prepared in India or imported from America, some consumer-trials could be carried out with it and the public given the benefit of demonstrations in regard to its varied uses. Arrangements could then be made for the importation of the necessary machinery.

THE INDUSTRY CAN BE EASILY STARTED AND EXTENDED

Some of the manufacturing firms in the country are already familiar with the methods of producing processed maize flour and also maize grit. They could obtain the required equipment and set them up if the necessary assistance is given. Once maize products could be made popular to the average rice and wheat-eating sections of the population, its future would be quite assured, and there will be enormous demand for maize products all over the country. The various factories in the country will have also have plenty of work to do; in fact many more new factories will be needed. The Government can investigate the matter through its Food Technical Panel and plan the organisation through its appropriate Food Industrial Panel.

Any important process successfully applied in the case of maize would also be generally applicable in the case of jowar and other coarse cereals. By suitable processing both human food in popular forms and also concentrated animal food out of the coarser fractions can be obtained. In this manner a balanced system of food production can be evolved with increasing benefit both to man and to

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AIR MASS INTERPRETATION OF SEN'S VORTEX METHOD OF WEATHER FORECASTING

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IN his review of Indian Weather in Köppen Band, Normand¹ pointed out that the concept of different air masses is old and implicit in the terms usually employed by the weather forecasters in India, but lacked the pictorial appeal of the theories which had then recently become common in the extra-tropical latitudes. A deep coast of monsoon current and a dry current were the main distinctions employed. Simpson and earlier workers² considered the monsoon stream as the continuation of the S.E. Trades of the southern hemisphere. Many workers tried to find out the different sectors and air masses that were required in the period of S.W. monsoon and for the cyclonic storms at other periods.³ Roy and Roy⁴ found that the monsoon depressions could be considered as

consisting of three sectors with the following air masses; (a) fresh monsoon air, (b) monsoon air deflected by the hills in N.E. India and (c) the dry continental air. The very nomenclature restricted the scope of enquiry into the ultimate origin and properties of the air masses. Due to various reasons the origin of the air masses was left vague by other workers also. The position could not be described as satisfactory. Many forecasters including the author were content to find facts which could be used as simple criteria and sometimes use the concept of air mass when the signs for the latter were definite. The analysis of extensive weather charts and a technique of uniquely drawing isobars,⁵ even when pressure gradients were weak and the number of ob-

servations few and far, showed that taking account of the sequence of the isobaric situation, weather and upper winds, the Indian weather could probably be attributed to three air masses.⁹

Equatorial Maritime Air (Em).—During the S.W. monsoon and in the pre- and post-monsoon months fresh maritime air crosses the equator from the south, at intervals depending on other meteorological conditions. It crosses the equator in a spurt (in a small interval of time) and there is a good interval of a few days before the next crossing can occur. To indicate this discontinuous and short-period crossing, the word 'pulse' of fresh maritime air has been employed. Before crossing the equator the character of the air mass is not the same throughout its history. It starts from one of the high pressure cells in the southern hemisphere as almost a dry continental stream (Tc) and in its westward travel gradually picks up moisture and some further additions of dry continental air. Later, due to the moisture content, it can be detected as a 'shallow' (in the sense of barometric defect at the centre and not as the height to which it extends) low pressure area moving in an almost west or, west-north-west direction. The air corresponds to the far-eastern transitional or mixed air (see below). When just about to cross and certainly after crossing, its properties would be Em. It can be made easily unstable and thunderstorms occur all along its path and weather over the sea would be squally. The diurnal variation of temperature in its mass is very small or even negligible as shown by observations at hill-stations. The temperature at sea-level is about 80° F. The air is not hot, but due to its becoming easily unstable it can release energy and act as a 'source' among the air masses.⁷

Far-Eastern Transitional or Mixed Tropical Air.—This contains a mixture of tropical maritime air and tropical continental air in varying proportions depending on the locality and season of the year. Though it may be hotter in some seasons (e.g. northern summer) than Em, it is more stable. Near the hills of N.E. India it can, however, cause thunderstorms. Its properties are described elsewhere.⁸ The monsoon 'pulse' (much before it crosses the equator to the other side) would resemble this air mass and this was the reason why the name transitional (transition from the Tc to Em in the course of the travel from one of the high pressure areas in the southern hemisphere to the northern hemisphere and reciprocally from the northern hemisphere to the southern hemisphere) was given and put as Tr.

Tropical Dry Air.—It has mostly a land origin and can be usually described as Tc with an occasional mixture of Pc. Its humidity is small and it shows a large diurnal range of temperature on the ground. It brings in unusually hot or unusually cold days over the region it passes over according as it is summer or winter period. For depressions forming in Bay of Bengal or in

Arabian Sea the air gets slightly modified due to its partial Sea travel.⁹

The three air masses could be separated, their effects and characters can be studied. In the height of northern winter (January or February), the first air mass rarely enters the Indian area and few tropical cyclonic storms (with a westward motion) form. Recently, the existence of the three air masses has been verified by the use of temperature and humidity data over the region S. China to N.E. India and Ceylon to Peninsular India.¹⁰

Sen and Puri worked a simple air mass technique for daily weather forecasting.¹¹ Later Sen discarded the method and introduced a theory of "Vortex Method".¹² With a weather chart which was limited in extent, the last method sometimes gave successful results, more so in detailed forecasting. There have been critics. As much thought has been spent to evolve the ideas and positive success attained, it is necessary to look deeper into the methods. As idea of air masses cannot be discarded, Sen's method must essentially be a part of a more complicated analysis where air masses are implicit and dominant. The restricted nature of Dr. Sen's analysis must cater to the finer details of weather forecasting.

It is, perhaps, useful to digress here, why the air mass concept becomes 'unconvincing' to many weather forecasters in the tropics when working with limited number of observations.

In the northern winter, the shallow low pressure areas or 'pulses', that cross into the southern hemisphere to feed into the tropical cyclonic storms or depressions there, are in the wind field of the "N.E. Trades". The winds are moving towards the equator and due to latitudinal divergence are gaining in stability, and the lines of partition between this (Tr) and other air masses are getting obliterated. (Just as in the case of cold fronts getting diffuse due to subsidence in the cold sector.) The N.E. Trades are passing over the sea before crossing the equator and would be absorbing moisture and getting heated. They cross as 'pulses' thereafter to the southern hemisphere. At this stage the air is unstable. This can only be unmistakably noticed within five or six degrees of the equator, a region generally ignored as 'doldrums' or as outside the area of many working charts. Occasionally this instability may be detected upto ten degrees or more in latitude, but it can be easily missed; as one is not out to look for it. The western disturbances indicate fronts on some occasions, but if the air is traced, it often happens that the partition is between sections of tropical air which had very nearly the same origin in the high pressure of west Asia but with different travels. (Both approximately eastwards, one over the land and the other partly over sea.) Occasionally, the N.E. Trades feed into the maritime part of the tropical air¹³ but may be missed due to the limited extent of the chart of a forecaster catering for N.W. India. The latitudinal convergence of air with a northward travel and the orography would seem to explain all his doubts.

In the monsoon months, the most important air mass Em is the most elusive one. The

S.E. Trades are towards the equator and the 'pulses' or shallow low pressure areas that bring in the fresh monsoon air to the north become very diffuse as they approach the equator. The pressure changes near the equator are very small and may even be less than the diurnal variation of it, so that its importance would be missed.⁵ The direction of wind would be disposed of as 'light and variable'. The time of crossing and the criterion of crossing would need very careful study of observations over a wide area on either side of the equator.¹⁴ The trajectories drawn with the help of pilot balloon observations from stations situated at great distances from one another can give misleading ideas (e.g., the S.E. Trades or 'pulses' go as far as Africa and then curve across the equator to feed into the Arabian Sea—the time sequence, the weather and winds at higher levels are all against it).

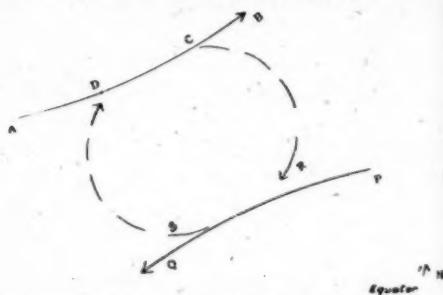
As for the far-eastern air Tr, it is partly N.E. Trades displaced northwards due to the shift of the seasonal lows and highs and has a slight equator-ward motion. It tends to gain in stability in the air mass and to make the partition with other air masses diffuse. Except in the neighbourhood of hills, thunderstorms are not common. But for the changing geometry of carefully drawn isobars and the sequence of rain in N.E. India, this air mass can be easily missed or ignored.

The third air mass is the continental dry air—its need is known. Its significance was missed, as with only one air mass which can be followed nothing exciting can result.

It is small wonder, if a forecaster in the tropics, handicapped with a limited chart and more limited number of observations and with air masses whose differences in temperature were much smaller than in the temperate latitudes, became sceptical of routine air mass technique in his area.

Consider now the winter conditions over India. Just north of the equator, in the lower levels of the atmosphere, there is an easterly or east-northeasterly flow of air due to the N.E. Trades. At higher latitudes, there is a westerly or west-southwesterly stream (the higher levels can be considered later). The easterly winds strengthen when 'pulses' or low pressure areas travel from the east and cross into the South Indian Ocean to feed the southern tropical cyclonic storm or depression. The westerly winds at higher latitudes feed into one or the other secondary low pressure areas of the western disturbances and themselves strengthen (see Fig.). When there is such a juxtaposition in the northern hemisphere, and easterly flow at a lower latitude and a westerly one at a higher latitude, the high pressure belt, in between, divides itself into cells of high pressure or a series of anticyclones. When there is no disturbance to the south or north of it, the anticyclone may be described as stationary in intensity and approximate position. The subsidence would be small and the air in it generally stable. The details of this configuration are given elsewhere.¹⁵ The anticyclone develops or intensifies when either the easterly or westerly stream strengthens, i.e., when the infeed of the Tr to the southern

depression (and sometimes to a secondary low of a western disturbance) or when the infeed into the western disturbances takes place. As



the shallow low pressure area representing the 'pulse' approaches the particular anticyclonic cell, the latter continues to develop. The 'pulse' may now cross the equator with a spurt (in a comparatively short period of time) and then the anti-cyclone will definitely weaken till the next low pressure area or 'pulse' approaches it. In the case of monsoon depressions in Indian area, Sen calls this sort of thing which occurs in the southern hemisphere as a strong anticyclogenesis which gives rise to cyclogenesis in Indian area. This may also be compared with the idea of strong surges of high pressure in the Mozambique channel giving rise to depressions in the Indian seas (com. Pendell and others). The main fact is that a 'pulse' of fresh monsoon air crossed the equator to feed into a tropical cyclonic storm or depression. The concomitant circumstance was the high pressure area or the development of the anticyclonic cell and its later recovery. The author has pointed out that (*Forecasting Weather*, etc., pp. 36 & 88) "At the time of crossing the equator (the 'pulse') the value of the morning pressure is generally above 1020 mbs. and shows a good rise from the value on the previous day. The pressure rise is almost contemporaneous with the crossing of the equator by the pulse" and "Just before the transport of the fresh maritime air across the equator, fairly strong pressure gradient may be observed south of the equator and sometimes the steep pressure gradient may be observed to extend as far as Mauritius..." As the high pressure area or the anticyclone is further away from the equator, it can be observed better but it would not justify to designate it as the cause.

If on the other hand, the 'pulse' did not cross the equator and moved westwards further, the next anticyclonic cell would develop and may release itself suddenly if now the 'pulse' crossed into the southern hemisphere. Otherwise, the anticyclone would release itself slowly and the next anticyclonic cell to the west of it will begin to develop.

If the 'pulse' or far-eastern air fed into the maritime part of air of the secondary low of an extratropical disturbance the anticyclone would gradually develop and would be displaced

eastwards as a northward travel of Tr would need a southerly stream to the west of an anticyclonic cell. The release would still be gradual. The recovery of the position by the anticyclonic cell would depend on the motion of the low pressure area to the north of it. The shape of the anticyclonic cell would depend on the relative position of Tr and the secondary low pressure areas of the extra-tropical depression.

If on the other hand, due to the secondary of the extra-tropical depression, the westerly stream strengthened, the anti-cyclonic cell would once again be developing. As the secondary low pressure areas travel almost E.N.E.-wards, one anticyclonic cell after another gets developed in an eastward progression. Some of the developed anticyclonic cells may allow Tr to feed into the secondary while in others such a contingency may not happen. While the movement of the complex low of the western disturbance is large and erratic, the development and recovery of the almost stationary cells of anticyclones in the seasonal high pressure belt can be observed more closely. If the complex low pressure area of the western disturbance is broken up into a series of distinct low pressure areas each of which is moving E.N.E.-wards and has a separate existence the problem of following the western disturbances would be very greatly simplified¹⁶ and here again this series of secondaries is the cause and the change in the anticyclonic cells a concomitant. When the extent of a weather chart is small, a fast-moving western disturbance can be detected by the changes in the anticyclones. During winter it is possible to hazard a guess that a western disturbance is approaching Iraq when the surface and the lower upper winds at Bahrain become more northerly or northeasterly and no observations from west of Bahrain are available.¹⁷ Similarly even though with the observations on the charts no low pressure area can be drawn, the development of the anticyclonic cell can indicate an approaching disturbance. In the first case the seasonal high is getting narrowed, displaced and intensified due to the approach of a western disturbance and the wind at Bahrain becomes more northeasterly than its usual north-westerly. The footsteps of a camel on a desert allow one to deduce the movement of a camel, as a result of past experience regarding the shape and direction of its footsteps.

In the northern monsoon, the easterlies are shifted northward in latitude (say about 20 to 35° N.) and the westerlies still further north. In the high pressure belt, the anticyclonic cells can still form and the development of the cell would depend on the far-eastern Tr feeding the monsoon depressions or to some western disturbance travelling at a higher latitude. As the western disturbances at a higher latitude 'pull up' the monsoon depressions and allow it to recurve,¹⁸ this would again be indicated in the displacement of the anticyclonic cell, and is a useful orientation in actual practice. To draw the anticyclonic cell or to see its displacement, it may not always be necessary to have winds all round, as with practice and experience one can judge it.

In the monsoon nearer the equator and south of it there is again a general high pressure

area with variations. Further down in southern hemisphere the high pressure area breaks up into cells. It is possible to imagine that with the anticyclonic cells to the north of the monsoon low and with the high pressure cells to the south of it, we have a street of vortices, and whose displacements and variations indicate weather, not easily deducible otherwise, with limited observations.

It follows, therefore, that the main thing is the movement of low pressure areas and the air masses connected with them as far as weather forecasting is concerned; and the anticyclonic cells (or vortices) are the indicators of the movement of air masses and low pressure areas. When this limitation is clarified, the indicative value of the anticyclonic cells can be fully exploited. This is specially useful to a forecaster whose chart is limited. The distance between two successive anticyclonic cells is determined from large dynamical considerations and the variation of the position and configuration of these anticyclonic cells is small from day to day so that patterns can be drawn and followed closer. If any cannot be drawn, due to lack of observations, it is possible to make a fair guess, and fill up the lacunae. A quick and unique way of drawing these anticyclonic cells, whether the wind field is strong or weak and variable, and the cataloguing of the variation in the cell due to types of disturbances that may be passing about it would be highly desirable.

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A NEW METHOD OF OBTAINING
SQUARES OF NUMBERS

MANY types of mathematical investigations often require squares of numbers of multiple digits. Barlow's tables and calculating machines not only have their limitations but are not always available to workers. A simple and ready method for obtaining squares of numbers containing any number of digits is illustrated here with typical examples.

(i) Square of a figure of two digits—95.

21
95

9025

Square of the first digit—25. Put 5 of 25 in the units place of the result and carry over 2; next multiply the first and second digits of the number, double the product and add 2, —92. Put 2 of 92 as the next digit of the result and carry over 9. Next square the second digit and add 9 of 92; that will give the last digits of the required square—9025.

(ii) Square of a figure of three digits—647.

321
647

418609

Square of the first digit—49. Put 9 of 49 in the first place of the result and carry over 4.

Next multiply the first and second digits, double the product and add 4—60. Put 0 as the next digit in the result and carry over 6. Next multiply the first and third digits, double the product and add to it the square of the second digit, and then add 6—106. Put 6 as the next digit in the result and carry over 10. Next multiply the second and third digits, double the product and add 10—58. Put 8 as the next digit and carry over 5. Next square the third digit and add 5, we get 41 as the last two digits of the result—418609.

(iii) Square of a figure of five digits—64537.

54321
64537

4165024369

Square the first digit—49. Put 9 as the first digit in the result and carry over 4. Multiply the first and second digits, double the product and add 4—46. Put 6 as the next digit in the result and carry over 4. Next, multiply the first and third digits, double the product, add the square of the second digit and then add 4—83. Put 3 as the next digit in the result and carry over 8. Next multiply the first and fourth digits, double the product and add to it the doubled product of the second and third digits, and then add 8—94. Put 4 in the result, and carry over 9. Next multiply the first and fifth digits and double the product, multiply the second and fourth digits and double the pro-

duct, square the third digit, add all the three, and then add 9—142. Put 2 as the next digit in the result and carry over 14. Next multiply the second and fifth digits, double the product and add to it the doubled product of the third and fourth digits and then add 14—90. Put 0 as the next digit and carry over 9. Next multiply the third and fifth digits, double the product and add the square of the fourth digit and then add 9—85. Put 5 as the next digit and carry over 8. Next multiply the fourth and fifth digits, double the product and then add 8—56. Put 6 as the next digit in the result and carry over 5. Finally square the fifth digit, and add 5, we get 41 as the first two of the result 4165024369.

The method can be similarly applied to figures extending to any number of digits. It may be noted that the method can be worked entirely mentally. I propose to give other methods in a number of subsequent communications.

Statistical Section,
Indian Agricultural
Research Institute,
New Delhi,
April 21, 1947.

AZIZUDDIN AHMAD SIDDIQI.

COLOURED LIMESTONES OF THE PALNAD AREA

SAMPLES from the limestone deposits occurring in Palnad in Guntur district exhibit an attractive variety of colours. A single piece of a few inches length taken from such samples is often found to have distinct zones which are very different from each other in colour. Two sections in juxtaposition but possessing shades of chocolate and pale green respectively are cut from the same plane of easy breakage. The relative behaviour of these two sections in the matter of certain physical properties has been studied by us.

Effective elastic constants are determined by the wedge method developed in this laboratory, and are given below along with the densities.

Colour	Density (gm./cc.)	Ultrasonic velocity (km./sec.)	Effective elastic constant (dynes/sq.cm.)
Chocolate	2.78	6.42	1.144×10^{12}
Pale green	2.69	6.52	1.147×10^{12}

The dielectric constants are determined by a liquid mixture method. The limestone section is moved between the plates of a condenser containing a liquid mixture, and the concentration of the latter is adjusted such that the introduction or withdrawal of the section does not change the capacity. Then the dielectric constant of the liquid mixture, which is equal to that of the solid section, is determined. The two sections are dried by heating at 200°C. for two hours and their dielectric constants are determined. Later, they are made to absorb different amounts of moisture, and the dielectric constants for different moisture contents

are determined. Results are given in the following table.

Moisture content in gms. per unit volume	Dielectric Constant	
	Chocolate coloured section	Pale green section
Dry	8.4 ± 1	7.8 ± 1
.0011	9.5 ± 1	
.0020 (equilibrium)	12.2 ± 1	
.0032	19 ± 5	
.0040	26 ± 1	
.0006 (equilibrium)		10.6 ± 1
.0014		15 ± 5

The two sections were dipped in water for half an hour, taken out, and their surfaces were wiped well. It was found that their moisture contents were first high but gradually decreased and attained equilibrium values in a day. The equilibrium moisture content for the chocolate-coloured section is .0020 gm./c.c. at which the dielectric constant is 12.2. The corresponding moisture content for the pale green section is .0006 gm./c.c., dielectric constant being 10.6.

Thus we see that the elastic constants of the two sections are the same and their dielectric constants are very near each other in the dry condition. The effect of moisture is different in the two cases. The two sections can retain quite different amounts of moisture in equilibrium. Further, for the same moisture content, the dielectric constant of the pale green section changes more than that of the chocolate-coloured section. It is suggested that the differences in colour have something to do with the probable differences in the particle size, the latter property also manifesting itself in the absorption and retention of different amounts of moisture.

The authors are grateful to Professor S. Bhagavantam for his kind interest in the work.

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Andhra University,
Physics & Geology Departments,
May 8, 1947.

ESTIMATION OF TOTAL CHLORINE IN BLEACHING POWDER

THE method that was being followed in this laboratory for estimating total chlorine in bleaching powder was as follows:—

- (1) Reduce an aqueous suspension of the bleach with hydrogen peroxide and estimate total chlorines by Volhard's method.
- (2) Reduce an aqueous suspension of the bleach with the exact quantity of arsenite required as determined in the usual manner for estimation of available chlorine; add 20 c.c. conc. HCl and distil into 10% KI. Titrate the

iodine solution which gives the equivalent of chlorate.

Total chlorine was obtained by adding the two chlorine equivalents.

This method involving three determinations (i.e., including the determination of available chlorine) and a distillation, was considered cumbersome, and the following was tried as an alternative.

0.3 to 0.4 gm. of the sample is mixed with ten times its weight of anhydrous sodium carbonate previously dried at 150° C. and placed in a platinum crucible. The mixture is covered with a layer of 5 gms. of anhydrous sodium carbonate. The crucible is gently heated on a pipe-clay triangle and raised to dull-red heat in not less than fifteen minutes, and kept at this temperature for 10 minutes. It is then cooled, placed in a covered beaker, the contents tipped out and dissolved in dilute nitric acid. Any salt left in the crucible is also similarly dissolved, the crucible removed by means of a pair of platinum-tipped tongs, and rinsed inside and outside with water into the beaker. The chloride in the solution is then estimated by Volhard's method.

In order to find out if any chlorine was lost during heating in the process, a short half-inch silica tube was packed successively with 5 gms. of anhydrous sodium carbonate, bleaching powder mixed with ten times its weight of anhydrous sodium carbonate, and another 5 gms. of sodium carbonate. A current of air freed from CO₂ and moisture was drawn slowly through the packing by means of a filter pump into a U-tube containing 10% KI solution containing starch as indicator. The portion containing bleaching powder was heated gently at first and then raised to red heat. There was no colouration of the iodide solution in 20 minutes. 0.3 gm. and 0.6 gm. of bleaching powder were also heated with negative results.

It is essential that the heating should be done gently at first and that the sodium carbonate should be anhydrous. The following table shows that the new method while quick and elegant gives figures that agree closely with those obtained by separate determinations of the various constituents of bleaching powder.

Serial No.	By Method (1)	Total chlorine By fusion with Na ₂ CO ₃
1	33.36	33.33
2	33.41	33.34
3	33.41	33.40
4	33.41	33.25
5	33.41	33.32
6	33.41	33.28

Our thanks are due to the Controller of Armament Development for permission to publish this note.

Inspectorate of Military Explosives,

Kirkee,

April 28, 1947.

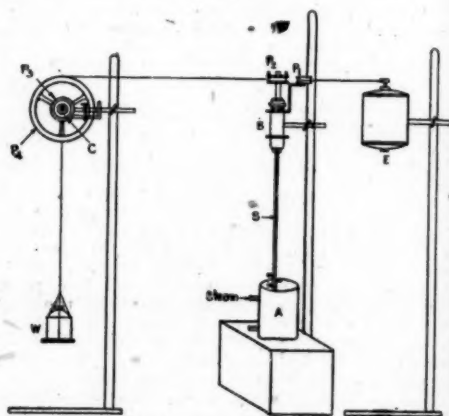
C. D. LAFFERTY.

K. S. VARADACHAR.

VISCOMETER FOR HETEROGENEOUS MIXTURES

THE usual kinematic type of viscometer is obviously unsuitable for heterogeneous mixtures in which a solid phase is uniformly distributed in a liquid phase, as for instance T.N.T. and ammonium nitrate over 80° C. For measuring the viscosity of such a mixture a simple apparatus is described here.

The principle on which the instrument is worked is the measurement of the time taken by a paddle to complete a definite number of revolutions under the force of falling weight, or alternatively the weight required to turn the paddle at a given speed.



VISCOMETER

The apparatus shown above consists of:—

1. A—Steam-jacketed aluminium can of 600 c.c. capacity.

2. S—Aluminium stirrer.

3. Gear System:

B—Bicycle hub, carrying the stirrer below and a mounting above, on which a detachable pulley can be quickly slipped on.

P₁ and P₂—Two detachable pulleys either of which can be taken on B. P₁ is operated by an electric motor during the preliminary process of stirring the material under test. P₂ is operated by the falling weight of during the measurement of consistency by material under test.

C—Bicycle hub.

P₃—Pulley attached to C, carrying the falling weight.

P₄—Larger pulley, coaxial with P₃ to unwind a thread from P₂, thereby causing P₂ to rotate.

4. W—Moving weight.

5. E—Electric motor 1/10 h.p. with an adjustable rheostat.

The procedure for measurement is as follows:

1. The mixture in can A at 97°C. is stirred electrically by means of E and P₁ for 20 minutes. The thread is meanwhile wound on P₃, bringing the weight into position, in readiness for the measurement.
2. P₁ is slipped off the mounting and replaced by P₂, which is prevented from rotation by a stop on P₄.
3. On removing the stop, W is set in motion causing P₃ and P₄ to rotate, as also P₂. The time taken for the weight to fall through a given height is measured by a stop watch. (The operation of changing over from P₁ to P₂ and starting P₂ in motion takes less than 5 secs.)

STANDARDISATION OF THE VISCOMETER

The standardisation of the apparatus is effected by using (homogeneous) compounded greases of viscosities determined independently in the Redwood viscometer. The greases are filled into A to a height of 4 inches and stirred at a constant rate (c. 600 r.p.m.) by means of the aluminium paddle (motor-driven) for 25 minutes at suitable temperature. The pulley geared to the motor is then taken off the spindle and immediately replaced by the pulley to be operated by the falling weight. The time taken by the weight to fall through a height of 45 inches is then noted (drop time).

The results on the absolute viscosities of the greases used and their drop times are embodied in Table I. The relationship between the viscosities and the drop times is linear, and under

centipoises as measured in the Redwood viscometer; t and t_1 are the drop times with different weights. The numerical constants in the equations have been derived by extrapolation.

It will be seen from Table I that the numerical values for viscosity calculated from either of the above formula using the drop times determined in the new instrument and with the two different specified weights agree very closely with the values determined in the Redwood viscometer.

The instrument thus standardised has been employed in testing the viscosity of hot amatol. Different compositions of the mixture with the same quality of ammonium nitrate and having the same grit size, and T.N.T. were prepared and viscosities determined (Table II).

TABLE II

Apparent viscosity of amatols of different compositions

Temp. = 97° C.
W. = 522.5 g.

Composition	Ammonium nitrate	40	45	50	55 parts
	T.N.T.	60	55	50	45 "
Drop time in sec.	..	10.3	12.6	15.1	17.5
Viscosity in centipoises	..	197	326	456	600

The increase in apparent viscosity proportional to the increase in solid component of the mixture, proves the utility of the instrument for comparative estimation of such mixtures of varying compositions.

The authors' thanks are due to Dr. H. R. Ambler, Chief Inspector of Military Explosives, Kirkee, for his help and suggestions, and to

TABLE I

Viscosity as determined by the new instrument and by Redwood
(T = 97° C.)

	Viscosity centipoises (Redwood)	Viscosity in centipoises as determined by present instrument			
		W = 522.5 g.		W = 422.5 g.	
		t (secs.)	n	t ₁ (secs.)	n ₁
Molten T.N.T.	6	6.9	6.4	—	—
Glycerine	18	7.1	17.6	8.1	19.6
Rubber based greases-1	164	9.7	163.2	11.2	164.8
" "	2	389	387.2	16.0	389.8
" "	3	776	773.6	24.2	774.0

the conditions of the experiment (temp. = 97° C.) is represented by the empirical formula:

$n = 56t - 380$, for a weight of 522.5 gm.
 $n_1 = 46.86 t_1 - 360$, for a weight of 422.5 gm.
where $n = n_1$ and is the viscosity required in

the Director of Technical Development for permission to publish the note.

Inspectorate of Military Explosives, Kirkee,
April 3, 1947.

B. N. MITRA.
B. M. MANEL.

CHEMICAL EXAMINATION OF THE FLOWERS OF MELIA AZADIRACHTA

Melia azadirachta is well known for its medicinal uses throughout India. The oil obtained from the seed kernel known commonly as 'Neem Oil' has been the subject of several investigations in the past.¹ Murti *et al.*² and Siddiqui³ have investigated the oil with a view to isolate crystalline non-glyceride components that may be responsible for its therapeutic properties and have reported the isolation of a number of substances, some containing sulphur and some free from sulphur but all characterised by marked bitter taste.

The flowers are reputed to be useful as a bitter tonic after fevers, to remove biliousness, and in the treatment of certain skin diseases.⁴ They have now been subjected to chemical examination with a view to isolate any special components that may be responsible for these properties.

Extraction of the dry material with different solvents in succession gave the following results:

Solvent	% extractive	Nature of residue
Petroleum Ether (60°-80° C.)	8.9	Yellow unctuous solid m.p. 41°-42°
Ether	2.0	Green waxy mass.
Chloroform	0.4	Soft yellow solid.
Alcohol 90%	12.5	Brown resinous semi-solid, markedly bitter.
Water	13.3	Brown resinous solid containing reducing sugars and tasting bitter.

For extraction on a large scale only petroleum ether and alcohol were employed.

PETROLEUM ETHER EXTRACT

The extraction was done in the cold (12 hrs.) three times. From the combined extract the solvent was removed by distillation first at ordinary pressure and finally under reduced pressure. The yellow unctuous solid left behind was treated with acetone in the cold and filtered. The white solid residue was waxy; it was crystallised from boiling absolute alcohol when it came out as a colourless solid melting at 60°-63° C. and having the following constants. Acid value = 5.8; Saponification value = 43.2; Unsaponifiable matter = 64.3 per cent.

The acetone filtrate from above was distilled under reduced pressure, when a golden yellow oil was obtained. It had a characteristic smell and an irritant bitter taste, and showed signs of decomposition when heated above 65° C. giving rise to irritant fumes. It did not contain any sulphur or nitrogen. It had the following properties. Refractive index (29° C.) = 1.4850; Acid value = 41.20; Saponification value = 123.20; Unsaponifiable matter = 38.1

per cent. The unsaponifiable matter was separated into two fractions by the use of hot alcohol. The less soluble fraction consisted of a waxy solid melting at 63°-65° C. which did not give sterol reactions, resembling the solid wax previously obtained. The more soluble fraction gave strong colour reactions for the presence of sterols.

The mixture of fatty acids obtained from the above oil was examined by Twitchell's lead-salt method and found to consist mainly of saturated acids. When heated at the temperature of the water-bath it showed signs of decomposition with production of irritant fumes just as the original oil itself.

ALCOHOL EXTRACT

The flower material left after petroleum ether extraction was extracted with boiling alcohol three times (6 hrs. each time). The viscous residue obtained by the concentration of the extract *in vacuo* was agitated with a large volume of ether to remove the ether-soluble portions. The ether-insoluble portion was taken in the minimum amount of alcohol and diluted with a large volume of water, when a brown amorphous powder (A) was obtained. It was sparingly soluble in most of the organic solvents and was not bitter to taste.

The ether extract mentioned above was repeatedly shaken with 5 per cent. sodium hydroxide solution, and the combined alkaline solution was acidified with hydrochloric acid. The solid obtained was soluble in alcohol and the solution gave an olive green colour with ferric chloride. By taking up the dry substance in dry ethyl-acetate and adding petroleum ether an yellowish brown, amorphous powder (B) was obtained in a small quantity. This also was not bitter. Major bulk was found to be resin.

The ether solution containing the alkali-insoluble matter was concentrated, whereby a soft greenish semisolid (yield = 1.3 per cent.) was obtained. It had a characteristic smell and was very bitter to taste. This was partitioned between petroleum ether and 70 per cent. aqueous alcohol and the two layers worked up separately. The solid obtained from the alcohol layer was dried and dissolved in benzene, and the solution diluted with petroleum ether. A light yellow powder (C) melting at 95°-100° C. with decomposition was obtained. It was markedly bitter to taste. It did not contain any sulphur or nitrogen. Its composition could be represented by the following empirical formula:

$C_{24}H_{40}O$ (Found: C = 68.2; H = 8.4; $C_{24}H_{40}O$ requires C = 68.6; H = 8.6).

From the petroleum ether layer a green treacly residue (D) was obtained. It was the most bitter of all the fractions, but could not be crystallised. It was non-reducing to Fehlings but reducing to alkaline permanganate. It was oil-soluble.

The main components of the neem flowers seem to consist of wax, oil and bitter substances (C & D). The bitter substances may be responsible for the tonic properties and the irritant oil may explain its usefulness in skin diseases.

Our thanks are due to Prof. T. R. Seshadri for his kind interest in this work.

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Waltair,
April 12, 1947.

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A NOTE ON THE CALCAREOUS MARL DEPOSITS OF U. P.

THE object of the present note is to record the (i) nature and occurrence, (ii) physical and chemical aspects, and (iii) the suitability of the marl, found in the districts of Lucknow, Unao, Rae Bareilly and Barabanki for economic purposes. These deposits were first discovered and studied for cement manufacture by R. J. Halliday, and the results were recorded in 1923.¹ Later on in 1941, the author carried out for about a year and a half the preliminary survey and prospecting of these deposits.

(i) *Nature and Occurrence.*—These are freshwater marls. The deposits are found in many places along the valleys of the rivers Sai, Gomti, Gogra, etc., or generally in the low lands, *jhils*, *tals*, swamps or the old beds of rivers. The marls lie under 6-15 feet of clay, and occur more or less as lenticular basin-shaped deposits of relatively small size. There is nothing on the surface which indicates deposition of marl underneath. Generally the areas are highly cultivated. It has been observed by the author that sugarcane grows quite profusely in the lands where the marls lie below.

(ii) *Physical and Chemical Aspects.*—Marl as found in nature is very wet, and may contain more than 30 per cent. of moisture. It is fine and sticky. The colour varies from grey to whitish grey. The darker colour is generally due to the presence of much organic matter, both mollusc shells and plants. The shells may sometimes be absent, whereas in some cases the marl is made up entirely of shells. The good quality marls usually contain very little of fine sand or grit.

It is a chemical deposit of calcium carbonate, containing 39 per cent. CaO. The alkalies are less than 1 per cent. while the silica is little more than 16 per cent. Fe₂O₃, TiO₂, and MgO, which are objectionable for cement manufacture are within the limits of British Standard Specifications for Portland Cement.

(iii) *Suitability for Cement Manufacture.*—It is generally felt that lime made out of marl is definitely better and cheaper than that from other sources. The tensile strength and expansion of the limes obtained from various sources support the above idea.

The physical and chemical studies of the marl-deposits reveal that they can be used for the manufacture of cement only after calculation, as the percentage of CaO is lower than

the one required by British Standard Specifications of Portland Cement.

(iv) *Extent of Deposit.*—The material is found in pockets up to 50 chains long and from 150-1,000 ft. in width. The thickness of marl varies from 3-12 ft. with an average of 4½ ft. and the overburden of clay is 4-12 ft. thick. The most important pockets are in the Basah Jhil in the Unao and Rae Bareilly districts.

(v) *Quantity Estimated.*—The total estimated deposit of marl in the three districts of Unao, Rae Bareilly and Lucknow is about 35.9 million tons. Besides these three districts, the areas in the district of Barabanki are yet to be examined.

(vi) *Facilities for Development.*—Owing to the nature and mode of occurrence of the material, the examination, prospecting and development present certain peculiar difficulties, such as inflow of water. The most suitable method for getting the marl would be by dredging, and the cost involved in this method is considerably lower than that of mining a limestone deposit. Further, the calcination treatment does not require much labour or huge machinery, since it requires only a small wet grinding and crushing plant, and the addition of bauxite to the slurry. The position of these deposits is ideal from the point of view of cheap labour and easy transportation to the factory and the market.

Department of Geology,
Benares Hindu University,
April 1947.

R. S. MITHAL.

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THE BIOLOGY OF *EARIAS CUPREOVIRIDIS* WLK.*

THE failure of cotton crop in the Punjab in 1905 and in Sind in 1906¹ brought spotted bollworms, *Earias fabia* and *E. insulana*, into prominence. Since then these two species have been under close investigation. A third species of *Earias*, *cupreoviridis*, however, has not been recorded from cotton, but only from some cultivated *Hibiscus* species and capsules of jute² in India; and this has only been casually studied. Fletcher,^{3,4} Fletcher and Misra,¹ and Haroon Khan *et al.*,⁵ recorded the host plants and distribution of this species in several tracts of India, while Hampson⁶ reported that the species is also found in parts of Africa and South-Eastern Asia.

For sometime *E. cupreoviridis* has been known as a pest of cotton in China,⁷ Formosa⁸ and Philippine Islands,⁹ and there is every danger of its attacking cotton in India as well. Some preliminary observations on the biology of this insect made at Delhi during the last two years are recorded here.

It has been observed that *E. cupreoviridis* remains active in Delhi from April to October hibernating for the rest of the year in the pupal stage as long as the mean laboratory temperature remains below 80° F. This species hence differs from *E. fabia* and *E. insulana* in

so far as it hibernates for a fairly long period. But during the period of activity its general behaviour is very similar to those of the other two species. In 1944 and 1945, the time at which the pupae entered into hibernation was not very variable. Caterpillars collected from field or bred in laboratory in the first fortnight of October or later entered into hibernation as they pupated. The date of emergence of moths from hibernating pupae, however, varied. In 1945 the first moth emerged on 20th March, the last one on 27th May, the largest number of them emerging in the first fortnight of May; during 1946 the first moth emerged on 26th March, the last on 5th May with the majority emerging in the second fortnight of April.

Further, it was possible to rear this species, generation after generation, all through winter, at two constant temperatures, 86° F. and 80° F. At both these temperatures the insect remained active and did not show any sign of hibernation. At 86° F. the total life-cycle was completed in about 23 days, while at 80° F., it took about 28 days. The total duration of life-cycle of this series is thus longer than that of *E. fabia* by about 3 days at 86° F.¹⁰ At other temperatures too this species takes somewhat longer than *E. fabia* to complete its life-cycle. Butac's (1933) observation fully supports this conclusion.

Therefore, temperature appears to be the main factor, if not the only factor, that brings about hibernation. With a view to studying the influence of low temperature on hibernation, some observations were made. A number of freshly formed pupae from larvae bred at 86° F. were exposed to 70° F., and moths emerged from all of them within three weeks. Again, fully-fed larvae reared at 86° F. were exposed to 70° F., where they pupated within two days, and from these also moths emerged within three weeks. On the other hand, pupae got from larvae kept at 70° F., when transferred to a high temperature of 86° F., took longer to emerge as moths as compared to the pupae from the larvae at 86° F. It is hence evident that low temperature acting on the larval stage and not the pupal stage bring about hibernation.

Humidity, which is another important ecological factor, does not appear to have any marked influence on hibernation; and during March-May when the hibernation ends, humidity generally remains very low; at high temperatures, as stated above, it was possible to rear generation after generation throughout winter months.

At Delhi *E. cupriviridis* has been found only on *Sida grevilloides* which is a common weed in this locality. Lefroy² and Fletcher and Misra¹ recorded some species of *Hibiscus* and jute as its hosts, while in the Punjab it has been bred from *Sida cordifolia* and *Malvestrum tricuspidatum*,³ two weeds commonly found in several parts of the province, and also rarely from two cultivated plants, *Hibiscus esculentus* and *Althea rosea*. In the laboratory this species was bred all along on *Hibiscus esculentus* without difficulty. With some difficulty the insect was also bred on flower-buds and bolls of cotton; and later, three consecutive generations were reared on the same food-

plant. Moths of the first generation as also of subsequent generations behaved quite normally and laid viable eggs. These observations suggest that the insect is a potential pest of *Hibiscus esculentus* (bhindi) on which it is found even under field conditions in parts of the Punjab, and it is also possible that it may at any time start attacking cotton. With the rapid extension of cotton and the evolution of numerous varieties of different texture there is every danger that this insect may divert its attention to cotton in India also.

The writer is indebted to Dr. Tashkir Ahmed, Imperial Entomologist, for giving all facilities for this work and to Mr. Sadiq Khan for help in rearing and other routine work.

Indian Agricultural Res. Institute,
New Delhi,

M. HAROON KHAN.

April 18, 1947.

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9. Butac, F. L., *Philippine J. Agriculture*, 1938, 2, 137.
10. Ahmad, T., and Ghulamullah, 1933, *Indian J. Ent.*, 1939 1, 17.

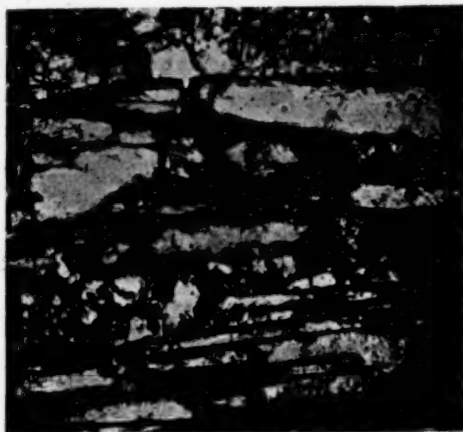
DIASPORE WITH PYROPHYLLITE FROM HAMIRPUR DISTRICT, UNITED PROVINCES

MISRA¹ has recently shown that the long-known deposits of steatite of Hamirpur district in U.P. are deposits of pyrophyllite. The main deposit occurs at Gorahri (79° 37'-25° 27') associated with quartz reefs traversing Bundelkhand-granites and gneisses. In no case is the mineral found in the granites and gneisses; it is invariably restricted to the quartz reefs. Three new deposits were subsequently discovered in the quartz reefs at Turra (79° 27'-25° 29'), Girwar (79° 29'-25° 31') and Pahari Garhi (79° 31'-25° 32'). A hydrothermal origin has been advanced for the origin of these deposits.

At Gorahri where regular mining is being done diaspoire was discovered in the form of geode-like bodies in the veins of pyrophyllite. The average diameter of these bodies measures about 5". The mineral shows compact masses, purple radiating crystals, and well-developed greyish-white pearly crystals up to 1.25" in length. The second variety is extremely brittle. The average specific gravity and hardness are 3.22 and 6 respectively.

Under the microscope thin sections show elongated blades and needles, and one set of fine cleavage lines are very characteristic, though sometimes traces of another set of cleavage lines are seen. Almost all sections show straight extinction with respect to the cleavage lines. The length of the mineral is

fast, and the optic axial angle appears to be very great. The average and maximum refractive index of the mineral are 1.70 and 1.74 respectively.



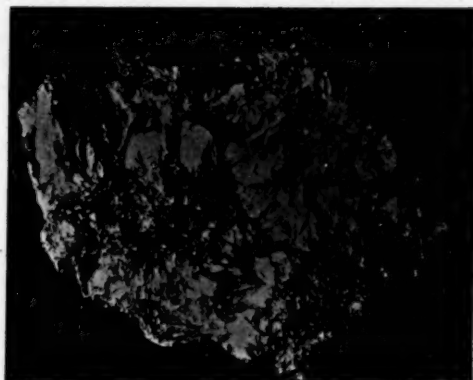
(1) By Ordinary light $\times 39$. Showing blades and needles of diaspore.

The purple variety had the following composition:—

Constituent	Per cent.
SiO ₂	3.71
Fe ₂ O ₃	0.07
Al ₂ O ₃	82.09
H ₂ O	14.53
Total	100.40

Analyst: C. P. Sood.

The impurities are evidently due to contamination from the associated pyrophyllite.



(2) Specimen of diaspore; 2/3 natura size. ehT prismatic crystals are arranged round a core of pyrophyllite.

In India diaspore has been reported in traces in the sillimanite gneisses of Bihar and corundum-bearing rocks of Rewah State.² The extensive aluminium ore of the Kashmir State is probably a diaspore and boehmite rock.³ The present communication is perhaps the first record of diaspore occurring as an independent mineral in the form of well-developed crystals. Its association with pyrophyllite is also noteworthy. In Japan it occurs at Shokozan in Bungo Province with alunite, pyrophyllite and kaolinite as a hydrothermal alteration of porphyrite.⁴

R. C. MISRA.
C. P. SOOD.

Dept. of Botany & Geology,
Lucknow University,
Lucknow,
March 28, 1947.

1. Misra, R. C., *Quart. J. Geol. Min. Met. Soc. Ind.*, 1944, 16, 46. 2. Mallet, F. R., *Diaspore with Corundum in Rewah State*, *Rec. Geol. Surv. Ind.*, 1872, 5, 22. 3. Rao, T. V. M., *Min. Mag.*, 1929, 22, 87. 4. Dana, E. S., *System of Mineralogy*, 1944, 1, 678.

THE ALKALOIDS OF XANTHOXYLUM BUDRUNGA WALL.

Xanthoxylum budrunga Wall. (Fam. Rutaceae) is a well-known indigenous drug valued as a remedy for intestinal complaints and general debility. Dieterle¹ traced an alkaloid in its bark, but could not isolate the base or its salts in the pure state.

The bark of *X. budrunga*, procured from Dacca, has been examined, and the results are given in this note. Two crystalline, coloured alkaloids were isolated in the pure state from the alcoholic extract of the bark. This offered considerable difficulty as the separation of the bases and their salts could not be effected by fractional crystallisation from pure or mixture of solvents. They could only be separated by hand-picking. The bases isolated from the bark appear to be new compounds, and have been called *Budrungain* and *Budrungainin* respectively.

Budrungain (yield 0.0025 per cent.) forms yellow rods from methyl alcohol and ethyl acetate, and chars above 180° C., but does not melt.

Budrungainin (yield 0.005 per cent.) crystallises from methyl alcohol and chloroform in slender shining orange needles which melt at 155° C.

The alkaloids are being further investigated.

I am thankful to Dr. S. Sen for kindly supplying me with the *budrunga* bark, and to Dr. A. Chatterjee for her interest and kind advice during the progress of this work.

Organic Chemistry Laboratory,
University College of
Science and Technology,
92, Upper Circular Road,
Calcutta,
May 12, 1947.

HARINARAYAN KHAISTAGIR.

¹ *Arch. Pharm.*, 1919, 257, 260.

POST-PARTUM ŒSTRUS IN THE INDIAN SHORT-NOSED FRUIT BAT, *CYNOPTERUS SPHINX* SPHINX (Vahl.)

Nycteris luteola (Thos.) appears to be unique among insectivorous Chiroptera in experiencing a post-partum Œstrus with at least two and possibly three pregnancies occurring in quick succession. Harrison Matthews¹ suggests that the above species may be polyœstrous.

Braestrup² considers it probable that in Tropical Africa insectivorous bats have two breeding seasons in the year. Do the Chiroptera breed twice in the tropical Indian climate?

Our information on the reproduction of fruit bats reveals that most forms have definite breeding seasons characteristic of the species. Bakers³ comprehensive list on Pteropidae indicates that they are monœstrous.

Phillips⁴ observed in the Indian Short-nosed Fruit bat, *Cynopterus sphinx sphinx* (Vahl.) from Ceylon, females with young during most months of the year, and remarks that the breeding is probably intermittent throughout the year.

My observations on *Cynopterus sphinx sphinx* (Vahl.) reveal that there is post-partum Œstrus and that at least two pregnancies occur in quick succession. Four adult specimens were obtained at Malleswaram (Bangalore), and three at Hoskote (sixteen miles from Bangalore) all of which while in lactation, and with young ones still clinging to the nipples were at the same time pregnant. The collection from each one of these places included also an adult male which was in full functional activity.

The period of gestation in *Cynopterus sphinx sphinx* (Vahl.) is about five months, while the period extends to six months (Baker and Barker³) and sometimes exceeds it (Ratcliffe⁵) in the other Megachiroptera. Pregnancy alternates between the two horns of the uterus and the ovaries function alternately. Sections of the ovaries show that the corpora lutea persist till parturition.

The available information indicates that this species differs from all other Megachiroptera in experiencing a post-partum Œstrus and that two pregnancies occur in quick succession in the month of April. The comparatively long gestation period of about five months precludes any possibility of this species being polyœstrous.

This is perhaps the first record of a Fruit Bat breeding twice a year.

Department of Zoology,
Central College,
Bangalore,
June 9, 1947.

P. A. RAMAKRISHNA.

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* I am very thankful to Dr. B. R. Seshachar, Central College, Bangalore, for encouragement and to the Council of the National Institute of Sciences (India) for the award of a Junior Research Fellowship.

ELECTROLYTIC REDUCTION OF *m*-NITRANILINE TO 2, 4-DIAMINOPHENOL

2, 4-DIAMINOPHENOL which is a valuable photographic developer, has been prepared from various starting materials derived from benzene. It has been obtained from 2, 4-dinitrophenol both by chemical¹ as well as by electrolytic methods,² and also by the electrolytic reduction of *m*-dinitrobenzene in strong sulphuric³ acid.

The only reference in literature to the production of 2, 4-diaminophenol from *m*-nitraniline is that of Gattermann³ who used a platinum cathode in the presence of strong sulphuric acid. The yield obtained by him was, however, not specified.

The electrolytic reduction of nitrobenzene to *p*-aminophenol in dilute sulphuric acid emulsion has been studied in this laboratory⁴ on a pilot plant scale, and a patent⁵ has also been taken out for the process. In a later publication from this laboratory,⁶ the electrolytic reduction of *m*-dinitrobenzene directly to 2, 4-diaminophenol in dilute sulphuric acid emulsion using certain catalysts has been reported. The process has now been extended to the production of 2, 4-diaminophenol by the electrolytic reduction of *m*-nitraniline.

m-Dinitrobenzene and *m*-nitraniline which were required in large quantities and in a high state of purity were prepared in this laboratory on a pilot plant scale following the procedures already reported in literature, and obtained in very satisfactory yields.

2, 4-Diaminophenol has been isolated as the sulphate in the crude condition, and has been obtained in the pure condition as the insoluble oxalate.⁷ By electrolysis *m*-nitraniline in 30 per cent. sulphuric acid at a monel cathode using a suitable catalyst and a current density of 2.3 amps./sq. dm., the yield of the crude sulphate amounts to 56 per cent. and the yield of diaminophenol oxalate to about 50 per cent. The diaminophenol sulphate obtained by this procedure is purer than that obtained directly from *m*-dinitrobenzene and this promises, therefore, to be a much better process for the manufacture of this important chemical on a technical scale.

Further experiments are in progress to improve the yield with special reference to the influence of such factors as current density, strength of catholyte temperature, cathode materials, catalysts, etc., on the material yields of the products. Fuller details of this investigation will be published elsewhere in due course. Our grateful thanks are due to the Council of Scientific and Industrial Research for kind permission to publish the preliminary results.

B. B. DEY.
H. VENKATAKRISHNA UDUPA,
B. R. PAI.

Presidency College,
Madras,
May 3, 1947.

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BLAINI-TALCHIR CORRELATION

A REJOINDER

In a recent note¹ J. B. Auden reasserts that Blaini boulder bed is Talchir or Upper Carboniferous in age and glacial in origin. Based on structural evidence he differs from my view that it is Tertiary tectonic breccia.

The new evidence adduced by Auden is from the bed of the Kosi river in Nepal. Here carbonaceous partings occur in sheared black shales found in proximity of boulder slate and associated with grey sandstone and dolomite. The dolomite forms the southern limit, and is thrust upon the Nahan series. In the north the whole zone is thrust over by the Dalings.

According to Auden the three rock types, boulder slate, carbonaceous shale and dolomite, are all normal marine sediments in proper succession and are not due to thrust movements. He considers the carbonaceous partings in shales as of lower Gondwana age, and correlates the boulder slate as Blaini with the Talchirs.

I cannot dispute the correctness of the field data for lack of knowledge of the area but I do consider that the data lends itself to a different interpretation. Firstly these series of sediments are sandwiched between the thrust against the Nahan and the thrust against the Dalings. It is, therefore, possible that shearing along the thrust has produced a boulder bed at the base. Secondly the presence of boulders of Krol or Subathu type of limestone within the boulder slate and of boulders of dolomite which is the top formation occurring as "horses" rolling within the underlying carbonaceous shales are features which are abnormal and can be explained as being due to mechanical mixture during Nappe movement of older rocks over younger ones. Auden's view of the concomitant formation of carbonaceous shale and dolomite from marine waters (Auden's Fig. 2) is rather farfetched. It seems more probable that fragments of old dolomite (of Krol age) got enclosed in the younger, though underlying carbonaceous shale which permeated in cracks within the dolomite blocks during shearing.

The Gondwana age attributed by Auden to Kosi carbonaceous partings rests on very weak evidence. The criterion of the Fuel Ratio favours a tertiary age. Gondwana coal is known to occur in the Himalayan foothills only east of Darjeeling, and no definite occurrence has, to my knowledge, been recorded west of it. What has definitely been recorded from the western, the Solon Lansdowne area, is that coal is a common constituent of the Tertiary-Subathu formation. It appears more probable as is further supported by the rock association that the Kosi occurrence represents the eastern continuation of the thrust Subathu-Krol belt rather than that it is the western prolongation

of the Darjeeling-Gondwana belt in spite of its nearness to the latter, since in Darjeeling area dolomite association is not a part of the Gondwanas but of the Baxas which correspond to the Krols which are known to have thrust over the carbonaceous subathus.

Apart from the lithological and structural evidence, the abnormal sequence, the frequent occurrence of the Blaini boulder bed in rock associations of different ages, its position in the field mainly coinciding with the thrust zones, the frequent occurrence of boulders and fragments of rock types of Krol, Infra Krol and of even younger ages as common constituents of the boulder bed, all these lead to the only conclusion that the boulder bed is of thrust origin.

My recent study of Mussoorie hills, though casual and incomprehensive, lends definite support to the tectonic origin of the boulder bed. Below the Vincent Hill School, south-west of Mussoorie, I came across a thick boulder bed below the Krol limestone. The boulders of all sizes and shapes were largely of the overlying Krol limestone though shales also contributed some fragments to the boulder bed. The matrix was partly clayey and partly calcareous in which pink limestone formed a conspicuous ingredient. A regular bed of pink limestone of Nummulitic type was found beneath the boulder bed which was succeeded further below by brown variegated shales of Subathu type. The field succession is illustrated in Fig. 1.



FIG. 1

From the above field evidence there is no doubt that the boulder bed which includes material derived from formations both below and above is a thrust breccia formed during the movement of the Krol Nappe over the Subathus. The age of the breccia bed is evidently Tertiary and is definitely not older than Eocene.

Thus it will be seen that both from direct lithological and from structural evidence in Solon and Mussoorie areas the Blaini Boulder bed is found to be of tectonic origin formed during Tertiary orogenic movements, and does not appear to have anything to do with Gondwana glaciation.

Rohtas Industries,
Dalmianagar,
January 23, 1947.

K. P. RODE.

1. Auden, J. B., *Curr. Sci.*, 1946, 15, 346.

THE Editor has kindly let me see the above letter by Dr. Rode before its publication and has allowed me to reply. The following brief points may be made with regard to some of

his assertions, which to my mind are incorrect. Dr. Rode argues that the Kosi coals are probably of Tertiary age on account of their low fuel ratios. In actuality the fuel ratio is no criterion of age in the case of the coals of the outer Himalayas, or of coals caught up by subsequent igneous activity, being an indication only of the metamorphism which the coals have undergone, either through shearing stress or by the thermal effects of intrusive rocks such as mica-peridotites. As stated in my letter of December 1946,¹ both the Eocene coals of Jammu and the Gondwana coals of the Darjeeling foothills have the same average fuel ratios. It may be remarked, however, that a further coal seam has recently been located by Mr. K. K. Dutta, Geological Survey of India in the Sunakhambi Khola, Nepal, which is less impure and has a fuel ratio of 3.22, so that the abnormality which I discussed in December is not characteristic of every seam in that neighbourhood. The analysis of this coal is given in Column 1 below:

	1 Sunakhamba Khola Left Bank, Kosi, Nepal	2 Bhitarka Khala, Left Bank, Giri River, Sarmar State, Punjab
	%	%
Moisture ..	2.38	0.72
Volatile Matter ..	11.92	7.56
Fixed Carbon ..	38.46	21.52
Ash ..	47.24	70.20
F.R. ..	3.22	2.98
Total Sulphur ..	0.33	1.26

(Analyses by Dr. R. K. Dutta Roy)

Of more value as an indication of age is the sulphur content. The average sulphur content of the peninsular Gondwana coals is 0.65 per cent., and of the Tertiary Assam coals about 5.0 per cent. The total sulphur content of the coaly matter of one of the Kokaha coals mentioned in my letter of December 1946 is 0.40 per cent. The total sulphur of the specimen in Column 1 above is 0.33 per cent., equivalent to 0.62 per cent., if all the sulphur is confined to the coaly matter and none of it occurs in the ash. It is highly probable, therefore, that the coals in the Kosi area are Gondwana and not Tertiary.

Dr. Rode states that Gondwana beds do not occur west of Darjeeling. This is incorrect because, aside from the recent finds in the neighbourhood of the Kosi river in Nepal, Gondwana coals have long been known, from the work of Sutton Bowman and others, to occur sporadically in Nepal as far west as longitude 82°. Moreover, it is possible that some of the carbonaceous rocks of the Mandhali series, closely associated with the Sataun limestone (30° 33' 77" 39') in Sirmur State, Punjab, may represent altered impure Gondwana coals. One specimen collected by me in 1943 from the Bhitarka Khala has the analyses given in

Column 2 above. This suggests the possibility that Permian coal conditions may also have extended further west than has formerly been realised.

Dr. Rode also states that coal is a common constituent of the Tertiary Subathu formation between Solon and Lansdowne. So far as I know, Eocene coal does not occur in the western Himalayas east of about longitude 76°, being mainly confined to Jammu. An Eocene late-rite, evidently equivalent to the bauxite of Jammu, is, however, known near Subathu and indicates a phase of sub-aerial oxidation.

Finally, Rode's interpretation of the Sirmur-Mussoorie area is so completely at variance with mine (and with that of W. D. West), that it is evident we are using given stratigraphic terms to describe quite different formations. No scale is given on Rode's section through Vincent Hill School, but the map shows that his section is about 3,000 yards in length. The nearest Blaini to Vincent Hill School along his line of section is 3,500 yards W.S.W., or some 1,300 yards beyond the end of his section. What Rode appears to have regarded as a Blaini breccia (according to him of Tertiary age) is in my view possibly either a penecontemporaneous limestone conglomerate belonging to the Krol D substage, or a lime-cemented scree deposit derived from the Krol series. Further, I know of no nummulitic limestone at the lower levels of the Vincent Hill School Ridges. According to my mapping, all the ricks exposed in Rode's section belong to the Upper Krol Stage.

So divergent, indeed, are our readings of the nomenclature, stratigraphy and structure that one is tempted to exclaim with the Voice out of the Whirlwind in the book of Job: "Who is this that darkeneth council by words ..."

Engineering Geology Section,
Geological Survey of India,
Calcutta,
March 18, 1947.

J. B. AUDEN.

1. Auden, *Curr. Sci.*, 1946, 15, 346.

SOMATIC CHROMOSOME NUMBERS IN SOME CULTIVATED CUCURBITS

CUCURBITACEÆ, a family of great economic importance, includes seventy genera and nearly seven hundred species. The somatic chromosome numbers have been studied in many a specie and genera¹ elsewhere, but very little work has been done in India. Somatic chromosome numbers have been determined in seven of the varieties recorded in Table I along with the previous records on the subject. The authors are recording the somatic chromosome numbers in *Cucumis melo* Linn. var. ? "Sarda"; *Cucumis melo* var. *utilissimus* Roxb. "Kakari"; *Cucumis melo* var. *momordica* Roxb. "Phunt"; and *Citrullus vulgaris* var. *fastuosus* Watt. "Tinda" for the first time. These findings agree with those of the earlier workers²⁻⁸ on other

TABLE I
Somatic chromosome numbers in some cultivated Cucurbits

No.	Name	Local name	2n	No. of Sat-chromosomes in the complement	Whether previously recorded or not	Somatic chromosome number in other varieties of the species
1	<i>Luffa aegyptiaca</i> , Mill. (Fig. 1)	'Ninawa'	26	..	n = 13, (Sutaria, ³	..
2	<i>Luffa acutangula</i> , Roxb. (Fig. 2)	'Taree'	26	..	2n = 26, (McKay ⁵ and Sutaria)	..
3	<i>Cucumis melo</i> , Linn. var ? (Fig. 3)	'Sarda'	24	2	New record	<i>Cucumis melo</i> Melon)
4	<i>Cucumis melo</i> var. <i>utilissimus</i> Roxb. (Fig. 4)	'Kakri'	24	2	..	2n = 24. Ya maha and S. ¹ and C. melo (Cantalaup) ² 2n = 24 Shifriss. ³
5	<i>Cucumis melo</i> var. <i>momordica</i> Roxb. (Fig. 5)	'Phunt'	24	2
6	<i>Cucumis sativus</i> , Linn. (Fig. 6)	'Khira'	14	..	n = 7, 2n = 14 (Kozhukhow ⁶ Heimlich, ⁷ McKay ⁵ and Passmore, ⁸	..
7	<i>Citrullus vulgaris</i> var. <i>fistulosus</i> , (Watt., Fig. 7)	'Tinda'	22	2	New record	<i>Citrullus vulgaris</i> (Water melon); 2n = 22, Kozhukhow, ⁶ 1925

varieties of the corresponding species. One

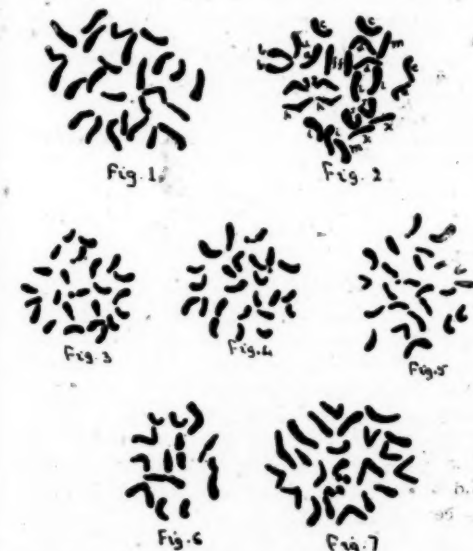
At Allahabad the root tips could be best fixed between 4-30 and 6-15 a.m. Maeda's modification of Navaschin's fixative was quite satisfactory. The results are given in the following table.

Prochromosomes were observed in the resting cells of the root tips of all the varieties investigated. A careful count of these from several nuclei showed that the number of prochromosomes corresponded with the number of somatic chromosomes in the plants.

S. P. NAIETHANI.
PURUSHOTTAM DAS.

Botany Department,
University of Allahabad,
May 19, 1947.

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pair of satellited chromosomes have been found in the new records.

A HINDU ASTRONOMICAL CLOCK

ACCORDING to Oriental sciences of Astrology and Astronomy time is measured in *Yamas*, *Ghatikas* and *Vighatikas*; but no mechanism has been known to indicate this system of division following the readings of the Hindu Almanac.

At the Nellore District Agricultural Exhibition held in March 1947 a big clock fitted in a wooden frame of about $3' \times 2\frac{1}{2}' \times \frac{3}{4}'$ was exhibited to the admiration of the public. The clock, unlike the *Jantar-Mantar* at Delhi and other devices, reads besides hours and minutes, *Thidhis*, *Warams*, *Nakshatrams*, *Lagnams* (with *Pushkaramsa*) and *Rahukalam* in *Ghatikas* and *Vighatikas* and also dates. All these are readable on a single dial though the hands are different. It is said to work with weekly winding, and the readings are based on 'Sowramana'.

It is the work of one Mr. Gongalla Krishnaiah, Doctor of the Rural Ayurvedic Dispensary, Mypad Village, Nellore District. The visiting public felt that the mechanism is useful for further research in Astrology and Astronomy.

To-day, when civilisation is said to be much advanced, time is expressed in *Yamas* and *Ghatikas* in Indian villages, as many villagers do not have time-pieces. Our ancient sciences are alive, but mechanical research is not there to produce suitable devices. This kind of clock does better service than a Radio set to the farmer. If researches of this kind are encouraged, they add to the fame of the country and serve the public from farmer to saint.

KALIDASU SANKARAIAH.

Thumadu,
Nellore Dt.,
May 22, 1947.

ORGANISING SCIENTIFIC TALENT IN THE COUNTRY

EVERY Indian who is associated with any scientific work in the country* will welcome the appointment of the 'Scientific Manpower

Committee' by the Government of India to survey, salvage and conserve available scientific talents for its full utilisation in future India.

The comparative fewness of attractive appointments in the scientific lines and the greater salaries, power and influence associated with posts in the executive and administrative lines have caused men of proved scientific abilities to choose other lines of service. Adequate recognition of scientific and technological talents has been slow in most countries and particularly so in our own.

Even inside a scientific or technical department of Government the administrative posts often carry much higher salaries than posts in the scientific line* with the result that after some years of service, the scientist looks forward to finish his career in non-scientific posts with their larger emoluments and pensions. I know of one young brilliant chemist who, after building up considerable work and reputation as chemist, ended his career as a second rate administrator. This was a distinct loss to science and not a service to administration.

The very tangible results of sugarcane work at Coimbatore was rendered possible through the worker—not very bright nor highly qualified—sticking to that work for thirty years. His colleagues thought he had a kink in his brain which prevented him looking around and above his post. In the agricultural departments of Government which need an immediate conservation of scientific talents I have known of persons, after decades of service in one crop, turn to another because of better emoluments.

The proposed Committee would do well to take note of these existing drawbacks as in the nationalistic India of the future the need for the conservation and proper utilisation of scientific talents is bound to be an important and urgent problem for working out schemes to the benefit of the mother-country.

56, Thyagaraja Road,
Thyagarayanagar,
Madras,
May 31, 1947.

T. S. VENKATRAMAN.

* *Curr. Sci.*, May 1947.

A PEACE TIME USE FOR MONAZITE

AMONG the latest developments announced by the Council for Scientific and Industrial Research is the use of Australian deposits of monazite in the manufacture of carbon electrodes for searchlights. The positive carbons of a modern searchlight usually have a core consisting of a mixture of powdered carbon and fluorides of the cerium group of metals. These materials required for making carbon

cores have been imported, but it has been found that sands from the beaches of Northern New South Wales and Southern Queensland contain considerable quantities of monazite, from which cerium fluoride can be prepared.

Cored carbons made from Australian materials have been tested in a searchlight arc lamp, and found to be in no way inferior to imported cerium fluoride.

REVIEWS

The New Plastics. By Herbert R. Simonds and M. H. Bigelow. (Von Nostrand Co., New York; Macmillan, London), 1946. Third Printing. Pp. 320. Price 25sh.

First published in May 1945, this book endeavours to cover the progress made during the preceding five years on various fronts in the plastics industry. Besides dealing with the methods of production and fabrication, properties and uses of various newer and improved types of plastics, the authors briefly discuss new processes, new methods of fabrication, and business statistics. Separate chapters are devoted to closely allied subjects of adhesives, fibres, protective and decorative coatings, synthetic rubbers, etc.

Among newer resins discussed are polyethylenes, nylons, silicones, polyvinyl carbozole and new alkyds. Other better established resins receive due attention such as the melamines, polyvinyl alcohols, allyls, vinylidene chlorides, zein, etc. Plastics derived from bagasse, wood, agricultural wastes and coffee also receive a brief mention, on which some work was also done in India during the war years.

Of particular interest to India, however, are the two shellac substitutes dealt with by the authors. Only one of which, namely, zinlac, is described in any detail. The other one developed by the Westinghouse Electric and Manufacturing Company is mentioned very briefly. Zinlac, based on zein resin, was developed specially as a substitute for shellac varnish for use as coating material. Although in some respects it is better than shellac, its price militates against its general adoption as a substitute during peace time. The Westinghouse substitute, on the other hand, was aimed at replacing the use of shellac in micanite manufacture, but no clue is given as to its basic composition or comparative properties. In spite of these and other developments in search of shellac substitutes, it must be remembered that, although a substitute may be found for one or the other uses of shellac, no single material is yet on the horizon which will be as versatile as shellac to supply the basic needs of some fifty or sixty industries.

If shellac is to fully exploit its superior advantages and hold its own in the modern age of plastics, attempts for stabilizing its price and standardising its quality must be redoubled and at the same time research activity should be vigorously pursued. The authors very rightly state that "shellac retained its popularity and usefulness, even though various substitutes appeared on the market, largely because extensive research to improve its quality and develop new uses has been carried out in this country (U.S.A.), in India, and in Great Britain". There is little doubt that the "formidable" competition predicted for the future can only be met, if research, development, standardisation and price-control activities are intensified.

While presentation and organization of the subject-matter in this book is excellent, giving general outlines of the topics dealt with, the reader will not find in it a penetrating and thoroughgoing treatment of theoretical and practical aspects of either the materials or the processes. The reason for this may be that the book was completed in early 1945, when detailed information on new developments was either not fully available or could not be given for reasons of security. Absence of references to original literature, with a few exceptions, further restricts the utility of the book for scientific workers. At any rate it may be recommended as a text-book for students who are interested in getting general knowledge related to recent developments in the plastics industry.

LAL C. VERMAN.

The Poetry of Mathematics and Other Essays. By David Eugene Smith. The Scripta Mathematica Library No. 1. (Published by Scripta Mathematica, Yeshiva College, Amsterdam Avenue; and 180th Street, New York, N.Y.), 1947. Pp. 90. Price \$1.25.

This small book was first published in 1934. It contains five essays which are of immense interest and bear testimony to the author's wide experiences, deep sensibilities and historical scholarship. As the book had gone out of print, the second printing, in 1947, is certainly to be welcomed.

The first essay is called "The Poetry of Mathematics" and it begins with Weierstrass's remark that "a mathematician who is not somewhat of a poet will never be a perfect mathematician." The remark would naturally puzzle any one who sees in the poet a sensitive lover of the concrete, dominated by a highly developed sense of life's values and given to emotional dramatization and regards the mathematician as an ardent devotee of the abstract, dominated by a tyrannical sense of the precision and given to impersonal ratiocination. The fact is that mathematics sets up patterns of ideas which have beauty, novelty and profundity and which in expression are terse, virile and convincing. These qualities are also experienced in poetry at its best. The author has given several interesting examples in support of this fact. It is shown that even elementary mathematical results have an æsthetic appeal of their own and that mathematics can, like poetry, satisfy the appetites of our higher self for truth and beauty.

The second essay is entitled "The Call of Mathematics" and the usual question is tackled, Why is mathematics studied? Some of the most crucial and vital laws of nature are quantitative and hosts of phenomena which are not governed by such laws do not fail to reveal an inner logic of events. It is not possible, therefore, to make a purposeful attack on life without cultivating a mathematical way of think-

ing and an intimate acquaintance with what G. H. Hardy calls "trivial" mathematics. The author shows how the whole fabric of modern machine civilization would collapse without mathematical support, and rightly argues that if the teaching of mathematics is not effectively done in schools and colleges the remedy is not to abolish it but to improve it. An anecdote of Lincoln is told how he interrupted his law studies with a perusal of Euclid to understand the precise meaning of the word "demonstrate". The author also indicates how the challenge of life provokes in man an intellectual curiosity and a sense of adventure which mathematics goes a long way to satisfy.

The third essay is on mathematics and religion. It shows in an interesting manner how certain theological dogmas are suggested by the familiar statements of certain mathematical propositions. In his conclusion the author says: "What we may safely assert, however, is this—that mathematics increases the faith of a man who has faith, that it shows him his finite nature with respect to the Infinite; that it puts him in touch with immortality in the form of mathematical laws which are eternal; and that it shows him the futility of setting up his childish arrogance of disbelief in that which he cannot see." While reading this essay the reviewer was reminded of Bertrand Russell's view expressed in *The Scientific Outlook* (1934, p. 16): "... the scientific attitude is in some degree unnatural to man; the majority of our opinions are wish-fulfillments, like dreams in a Freudian theory. The mind of the most rational among us may be compared to a stormy ocean of passionate convictions based upon desire, upon which float perilously a few tiny boats carrying a cargo of scientifically tested beliefs." Any one who is familiar with recent developments in modern mathematics, particularly, regarding the foundations of the subject, may consider the author's account of the nature of mathematics antiquated and invalidated. Since there is no logical connection between mathematics and theology one can only admire the theological earnestness of the author for using purely mathematical results to strengthen his faith.

The remaining two essays are about Jefferson and Monge. They are different in character from the rest of the book, but one can read them with profit and interest. The book is thought-provoking, nicely written and beautifully printed. It would make an excellent addition to any college library that does not already possess a copy of the first edition.

V. V. NARLIKAR.

Advances in Carbohydrate Chemistry, Vol. II.

Edited by W. W. Pigman and M. L. Wolfrom. (Academic Press Inc., Publishers, New York, N.Y.), 1947. Pp. 323. \$6.6.

This volume presents ten topics in the form of reviews by carbohydrate chemists of America, England and France.

1. *Melzitose and Turanose* (C. S. Hudson).—Melzitose, of the more important and widely distributed sugars of nature, is shown to be 3-(D-glucopyranosyl)-D-fructofuranose <-> D-

glucopyranose. The structure of turanose is established conclusively as 3-alpha-D-glucopyranosyl-D-fructose.

2. *The Chemistry of Anhydro Sugars* (Stanley Peat).—The chemistry of anhydro sugars is dealt in detail, and evidence is adduced that anhydro sugar formation by the hydrolysis of the sugar ester of a non-carboxylic acid depends on the fact that in the preliminary stages of hydrolysis a carbonium ion is formed followed by a trans exchange of anionoid groups, inversion taking place. One of the most striking interconversions of sugars in nature is the smooth elegance with which D-glucose is converted into D-galactose in the mammary gland. The acid most likely to function biologically is phosphoric acid and the conversion of D-glucose to D-galactose through the intermediate formation of D-glucose-5-phosphate and subsequent intramolecular anion exchange on C5 and C4 respectively, is a very attractive picture.

3. *Analogues of Ascorbic Acid* (F. Smith).—Four main methods are available for the synthesis of analogues of L-ascorbic acid. Up to the present simultaneous lactonisation and enolisation of 2-keto-3:4-dihydroxy acid or esters is the most successful for synthetic vitamin C on a commercial scale. Antiscorbic power is dependent on the stereochemical configuration of the molecule as a whole. High antiscorbic power is also reported to be shown by a derivative of L-ascorbic acid in which the enolic hydroxyl at C2 is replaced by an amino group.

4. *Synthesis of Hexitols and Pentitols from Unsaturated Polyhydric Alcohols* (R. Lespieau).—Syntheses have been accomplished by the elegant oxidative hydroxylation of di- and mono-vinylglycols by means of a solution of silver chlorate containing a small amount of osmic acid.

5. *The Interrelation of Carbohydrate and Fat Metabolism* (Harry J. Deuel Jr. and Margaret G. Morehouse).—A critical assay of a mass of papers reviewed reveals that the present information must be construed as giving a negative answer to the possibility for the conversion of the fatty acids into carbohydrates. In the animal body glycerol can be quantitatively converted into D-glucose. To explain the mechanism of ketosis (accumulation of ketone bodies in the blood) two theories have been put forward: ketolysis and antiketogenesis. Both these theories, however, fail to give a complete picture.

6. *The Chemistry of Mucopolysaccharides and Mucoproteins* (M. Stacey).—The field covers carbohydrate and protein chemistry. The study of pneumococci has resulted in their classification into forty different serological types which differ according to the structure of their capsular polysaccharides. Heparin probably contains a basic tetrasaccharide unit. Chondroitin sulphate is found to be a derivative of Duconic acid. Chitin may be regarded as 2-acetamido cellulose. The chemistry of mucoproteins is being actively persuaded.

7. *Bacterial Polysaccharides* (Taylor H. Evans and Harold Hibbert).—Polysaccharides, in combination with proteins, are responsible for the immunizing power of many bacteria and the

structure of the polysaccharide determines the specific immunological response to these organisms. Bacterial cellulose, dextran and many other bacterial polysaccharides are composed entirely of D-glucose units, the levans are condensation polymers of D-fructose. The polysaccharides of pathogenic bacteria are usually composed of more than one carbohydrate.

8. *The Chemistry of Pectic Materials* (E. L. Hirst and J. K. N. Jones).—By selection of an appropriate pectin in which the desired component is present in suitable proportion, it is possible to separate either the pectic acid portion or the araban in a sufficient state of purity for structural investigation. The evidence so far available suggests that pectic materials from a wide variety of sources contain the same araban, a branched chain polysaccharide built up mainly, if not entirely, of L-arabofuranose residues. Peanut galactan consists of a chain of 120 D-galactopyranose units in the 1:4-beta-links.

9. *The polyfructosans and difructose anhydrides* (Emma J. McDonald).—Hydrolysis of trimethyl-inulin gives 3:4:6-trimethyl-D-fructofuranose. Inulin is, therefore, made up of D-fructofuranose residues joined through carbon atoms 1 and 2. Four difructose anhydrides have been isolated as well-defined crystalline compounds. Anhydrides I, II and III have been isolated from non-reducing residues that remain after a removal of D-fructose and D-glucose from acid-hydrolysed inulin. Anhydride I is 1:2':2:1'-di-D-fructofuranose anhydride and III is the 1:2':2:3'-di-D-fructofuranose anhydride.

10. *Cellulose Ethers of Industrial Significance* (Joseph F. Haskins).—Cellulose ethers of a high degree of substitution are stable, relatively nonflammable, resistant to ultraviolet light and compatible with a wide range of solvents and plasticizers. Various experimental factors are involved in the etherification of cellulose. For use as plastic material, ethyl-cellulose and benzylcellulose have had the greatest commercial development. Several groups as methoxyl, hydroxyethyl and carboxymethyl, when present in proper amounts, render the cellulose derivative soluble in water.

President W. N. Haworth, in his address to the Chemical Society (April 19th, 1945) says: "It is a curious fact that some of the most notable advances in the chemistry of starch have been made during the stress of this and earlier wars . . . in the present war we have witnessed the enzymic synthesis of both amylose and a mylopectin."

On reading through the volume under review one is almost tempted to add—the addition of two outstanding treatises on *Advances in Carbohydrate Chemistry* have also been added to the literature during the action and reaction of the global war. The editors as well as the contributors command the thanks of all chemists for putting into their hands such a readable and informative volume. It will prove indispensable to all who have ambitions of learning the recent advances in the field.

K. N. M.

Recent Progress in Hormone Research. Proceedings of the Laurentian Hormone Conference, Vol. I. Edited by Gregory Pincus. (Academic Press, Inc., Publishers, New York, N.Y.), 1947. Pp. 398. Price \$7.50.

Symposia are always very stimulating to scientific thought and investigation, and the present one is no exception. It contains a most interesting series of articles on hormones, giving critical evaluations and work-in-progress by leading investigators, and is valuable not only as record of knowledge and accomplishment but as incitement to research. The purpose of the conference, to nourish the spirit of inquiry, which dies without criticism and discussion, is fulfilled.

The book is divided into four sections. The first section contains an article by Nachmansohn on the role of acetylcholine in the mechanism of nerve activity. For the theory to be complete, however, the role of adrenaline has also got to be elucidated side by side. If there are no cholinergic nerve endings in the accepted sense of the term, then there must be no adrenergic ones. The second article by Beach, gives an account of the action of hormones on mating behaviour in vertebrates. The second section contains articles by Kendall, Gallagher, Long and Pincus and deals with the chemistry and action of the hormones of the adrenal cortex. The chemical and the physiological investigations are a brilliant piece of research. The third section deals with the role of hormones in metabolic processes, and contains articles by Samuels, Kochakian and Gardner. The fourth section deals with certain aspects of clinical endocrinology, and contains articles by Nathanson, Albright, Talbot, Sobel and Grollman and are of great value from the clinical standpoint; they represent an important advance in several directions. The whole symposium is a record of the latest advances in this branch of physiology. The articles and discussions certainly act as hormones to the creative processes of scientists in this field.

INDERJIT SINGH.

Sugarcane Cultivation. By K. M. Gururaja Rao, 139, Margosa Road, Malleswaram, Bangalore. Foreword by Sir T. S. Venkatraman. Cr. 8vo. Pp. xvi + 127, with 24 Illustrations. Price Rs. 4-8-0 net.

This is a very useful and timely publication on the cultivation of sugarcane, an industrial crop which forms the raw material in the sugar industry in which India has invested about thirty-two crores of rupees—the largest investment next to Textiles. It is unfortunate that even after fifteen years of tariff protection the industry cannot be said to have reached a stabilisation, as seen by the Government extending its protection for a year more. In the agricultural economy of India the crop occupied in 1945-46 an area of 38,47,000 acres. The average yield of cane per acre is about 15 tons against 45 tons in Java. Whatever increase is seen is due to improved varieties of cane, the cultural and manual influences hardly playing their deserved role, due, among others, to the cultivators' preoccupation with as remunerative, less exacting and short-duration crops.

Even on factory plantations, where sugarcane is expected to be grown under strict administrative and scientific control the yields are poor—15 to 20 tons per acre. In thick cane areas as in Madras, Mysore, Hyderabad and Maharashtra, except for average yields of about 35-40 tons in Maharashtra, the rest of the area has not showed any improvement over the average of 18-20 tons (*vide Review of the Sugar Industry of India for the year ending 31st October 1945*). This is a serious position and deserves attention of Government as well as the factories.

Against the above background the present publication is welcome, not because it contains, as in Part I, valuable information culled here and there from published records on sugarcane, but, which is important, as a method of cultivation evolved and successfully applied on a plantation-scale over twenty-five years of author's active life. Successful crop-growing demands an intelligent and integrated application of intimate knowledge of a number of agricultural sciences, which is vitiated by the present-day tendency for specialisation. The author speaks of his intimate experience in growing sugarcane, avoiding undue influence of mere book-learning, and the book is the result.

Part 1 treats, in general, the theory influencing the subject. History of sugarcane, distribution of cane areas, the sugarcane plant, its propagation, periodicity of growth, theory of formation of sugar, varieties, soils and their properties—chemical, physical and bacteriological, colloids and their function, fertilisers, yields of sugarcane and their field estimates, insect pests and diseases of sugarcane are dealt with in eight chapters.

Part 2 describes, with a wealth of detail, the method of cultivation. It consists of eight chapters dealing with climate and soil, the need to map out soils, growing of green manure crop as a preliminary to cane, methods of ploughing, laying out plot, drains, kinds of sets used for planting, raising nurseries, filling gaps, details of manuring and their dose, different methods of irrigation, maturity in cane, ratoons, etc.

There is a very useful summary of recommendations at the end.

There are 23 Appendices of an informative nature on the subject.

The book is profusely illustrated with 24 helpful sketches and halftone blocks.

It is a book which would be found useful to every sugarcane-grower, from fieldman to manager in sugarcane plantations.

Manuring of Cotton in India. By V. G. Panse. (Indian Central Cotton Committee), 1946. Pp. 63. Price Rs. 5.

This publication from one of our abler statisticians, who is also well acquainted with the crop, is a welcome contribution to a very important problem. In the course of about 60 pages the author has critically surveyed over 420 field experiments conducted all over India in the course of about fifty years. He has drawn certain important conclusions and indicated the lines of future work.

The first part is a summary of the results of earlier manurial trials. This has revealed that, of the three major elements, nitrogen is the only one that produces a consistent response. Ammonium sulphate has proved more dependable than organic manures, especially farm and manure and compost, though in some areas seed-cakes have also proved quite satisfactory. The optimum time for application varies with the source of nitrogen and locality. The best method of applying the fertiliser has yet to be studied more thoroughly.

The second part deals with the economics of nitrogen manuring and is a statistical study of the results so far obtained. On black soils the optimum dose of groundnut cake is about 500 lbs. which is equivalent to about 40 lbs. of nitrogen per acre. Irrigated cotton responds better than the rain-fed crop, and about 50 lbs. of nitrogen per acre seems to be an efficient economic dose. The analysis has revealed the importance of the amount of rainfall, drainage and salinity of soil in determining response to nitrogen. Interestingly enough, the conditions which determine the yield are the same as those which determine the response to nitrogen.

The third part deals with the planning of future work and emphasises the need for further study on the quantity of nitrogen, alternative sources of nitrogen, time of application, method of application, application of phosphate, varieties of cotton, response to rain-fed and irrigated conditions and so forth together with the heads under which data have to be collected.

Although the author has dealt with the economics in terms of cash, there is yet need for information bearing on the actual utilisation of the manure or fertiliser applied. Thus, what part of the nitrogen is actually taken up by the crop? It is now generally recognised that owing to the somewhat alkaline character of most cotton soils, there will be continued loss of nitrogen as ammonia. Is there any way of preventing this loss and making the nitrogen more available to the crop? Can we treat fertilisers directly or otherwise make additions so as to reduce the risk of the continuous loss of nitrogen? An important finding in this direction may prove to be very useful in practice. It is hoped that the new programme of field experiments initiated by the Cotton Committee will include such studies.

V. SUBRAHMANYAN.

Chemicals from Methane. By J. P. Lawrie, Ph.D. (Science Service Ltd., 255, Russel Court, London, W.C. 1), 1947. Pp. 21. Price 3/-.

Dr. J. P. Lawrie, the author of *Methane—Production and Use*, puts forth in this booklet of 16 pages of readable matter, a strong plea for the profitable utilisation of natural gas and other sources of methane of which very considerable supplies exist in England. He describes in outline the methods of preparation of carbon black and other products from methane albeit a few of them are at present only of theoretical interest. This booklet, written in a simple way, should find favour with the general reader.

P. L. N. RAO.

Indian Minerals—A Quarterly Journal issued by the Mineral Information Bureau, Geological Survey of India, Calcutta.

Current Science has great pleasure in welcoming the publication of the magazine, *Indian Minerals*, issued by the Mineral Information Bureau, Geological Survey of India, Calcutta.

It was a long-felt desire to have a journal which could publish popular articles on Indian minerals. Information on the mineral wealth and articles concerned with the strategic minerals of India, were being published in the Annual Reports of the Records of the Geological Survey of India. These were, however, available mostly to Geologists. It is a great pleasure that this information has been made available by *Indian Minerals* to the rest of the enlightened public.

The magazine welcomes short notes on research in progress, but it mainly confines itself to popular articles. It is very informative with up-to-date facts and figures, and is printed on good art paper.

We congratulate the sponsors on the venture and wish all success to *Indian Minerals* in its career.

B. R. C.

The Indian Cotton-Growing Review—Journal of the Indian Central Cotton Committee. (The Secretary, Indian Central Cotton Committee, Nicol Road, Ballard Estate), Bombay. Rs. 2 per annum.

The Quarterly Review is a welcome addition to the other publications of the Indian Central Cotton Committee dealing with its research work and practical achievements. Useful as the memoirs, annual reports and articles on cotton in different journals were, they could not supply the need for a regular periodical exclusively devoted to cotton. The cotton industry in India occupies a place of eminent priority both in the agricultural and industrial economy of the country. The researches on this product cannot, therefore, be too widely published. With growing competition from rayons, glass fibres and other cotton substitutes the importance of cotton research and exploitation can be very well recognised. The Indian Cotton-Growing Review should go a long way in helping the cotton-grower and industrialist adopt the latest methods and improvements in cotton research. We wish the Journal a long and useful career in the service of the Cotton Industry.

K. S. R.

Advances in Carbohydrate Chemistry, Vol. I. Edited by W. W. Pogman and M. L. Wolfrom. (Academic Press Inc., New York), 1945. Pp. xii + 374. Price \$6.00.

The reviewer's first reaction on encountering an annual publication devoted to a single

group of chemical compounds was a feeling of dismay at the tempo of scientific progress which necessitates such a publication and the narrowing down of interests implied by it. But a perusal of the contents of *Advances in Carbohydrate Chemistry* has been more than reassuring. The eleven articles in this volume are written by well-known specialists but are written not only for the specialists but also for the general student of chemistry. The authors have not confined themselves to literature surveys of "recent advances" but have, in accordance with the avowed policy of the editorial board, provided critical and integrated reviews on the subjects covered by them. Thus the first article on "Cynohydrin synthesis", by C. S. Hudson, gives in thirty-six pages a masterly and extremely readable summary of nearly hundred years' work. Commencing with the first synthesis of α -hydroxy acids from the cynohydrins of carbonyl compounds it deals in chronological order with Kiliani's application of the reaction to convert reducing sugars to the corresponding sugar acids, Fischer's reduction of the lactones of these acids to give higher carbon sugars and leads on to the recent work, much of it carried out in the author's own laboratory on the synthesis of monosaccharides containing from seven to ten carbon atoms, the methods of identification of higher sugar alcohols and the bearing of these discoveries on the configuration of the sugars. There are similar valuable surveys, complete in themselves and covering ground that is already well consolidated but containing much material unfamiliar to the average chemist, on "Carbohydrate Orthoesters", by Eugene Pacsu, on the "Altrose Group of Substances", by Richtmyer, on "Thio- and Seleno-Sugars", by Raymond, on the "Carbohydrate Components of Cardiac Glycosides", by Elderfield, and on the "Chemistry of Nucleic Acids", by Tipson. The papers on "The Fractionation of Starch", by Schoch, and the discussion on "Methods of Research in Plant Polyuronides", are of necessity of the nature of surveys of recent advances. The industrial bearing of carbohydrate chemistry is represented by two articles, by Roy Whistler on the "Preparation and Properties of Starch Esters", and by Charles Fordyce on the "Cellulose Esters of Organic Acids", and the biological aspect by the article of Carr and Krantz on the "Metabolism of Sugar Alcohols and their derivatives". The volume is of undoubted help not only to those specialising in carbohydrate chemistry but also to research workers in other fields. The second volume will be eagerly awaited by all interested in keeping abreast of developments in carbohydrate chemistry.

M. DAMODARAN.

SCIENCE NOTES AND NEWS

ATOMIC ENERGY RESEARCH

Mr. C. Rajagopalachari, Member for Industries and Supplies, Interim Government, recently announced the formation of an Advisory Board for Research in Atomic Energy. He said, "I am glad to announce that a Board of Research in atomic energy has been set up under the auspices of the Council of Scientific and Industrial Research with Professor Bhabha as Chairman. There are large deposits of monazite sand in the Travancore beaches, which is a valuable mineral required for the production of atomic energy. Perhaps the richest thorium ore in the world is to be found in the monazite sands of the Travancore coast. I am glad we have negotiated the agreement by which the mineral conservation policy of the Government of India can be given effect to in this connection.

"We shall have a Joint-Committee consisting of six members of the Board appointed by the Council of Scientific and Industrial Research and three representatives of the Travancore Government. The function of this Joint-Committee will be to advise the two Governments on all matters connected with research and development and the disposal and utilisation of raw material. I am especially glad to be able to announce that this Joint-Committee will be the authoritative advisory body both for the Government of India and for the Government of Travancore, thus bringing this important branch of power research and disposal of raw material into one co-ordinated scheme.

"The Joint-Committee will consist of Prof. H. J. Bhabha (Chairman), Prof. Meghnad Saha, Mr. D. N. Wadia, Dr. Nazir Ahmed, Sir K. S. Krishnan, Sir S. S. Bhatnagar, Dr. K. L. Moudgil, Mr. K. P. Menon and Mr. V. Mahadevan.

"I am grateful to Sir C. P. Ramaswami Aiyar, Dewan of Travancore, for the co-operation he has extended in this matter. We had deputed Sir S. S. Bhatnagar and Prof. Bhabha to go to Travancore and discuss matters with him, and the present arrangement is the result of those negotiations. The public may rest assured that the atomic energy resources of India will not be frittered away or go to waste."

MICA RESEARCH

The Travancore Government have entered into an arrangement with the Government of India for the purpose of conjoint research on mineral sands and mica research. They had also entered into certain arrangements with influential British concerns for a joint research and exploitation of the mineral sands of Travancore and production of atomic energy.

MINERAL DEVELOPMENT IN HYDERABAD STATE

Exploratory work to ascertain the occurrence of valuable mineral in different parts of the Nizam's Dominions has commenced under a

scheme sanctioned for the expansion of the Mining and Geological Survey Department.

The occurrence of further deposits of coal is being ascertained near the Singareni collieries and Jangaon, and gold development work at Hutti, Lingsoor Taluk, Raichur District, which had been suspended during the war, has been resumed.

Prospecting operations conducted recently in Asifabad Taluk, Adilabad District, are stated to have shown good deposits of clay suitable for manufacturing porcelain ware.

In Khammam Taluk, Warrangal District, prospecting operations have disclosed workable deposits of mica, and regular mining operations are in progress.

In the eastern parts of Paloncha, Warrangal District, abrasive minerals like garnet, alusite and kyanite have been discovered in appreciable quantities and are being leased out.

Corandum, which is a refractory mineral, is also found in abundance in the eastern parts of Paloncha.

PROTECTION FOR FRUIT INDUSTRY

The Government of India has decided to grant protection to the preserved fruits industry for a period of three years.

The Tariff Board, which considers that the industry has been established and conducted on sound business lines, recommended a protective *ad valorem* duty until 1950 of 60 per cent. on canned and bottled fruits; 40 per cent. on fruit-juices, squashes, cordials and syrups; and 80 per cent. on jams, jellies, marmalades and candied and crystallised fruits.

RADIO SONDE STATION FOR TRAVANCORE

"Radio-Sonde" station has been established at the Trivandrum Observatory by the Indian Meteorological Department and the first flight was conducted on 25th May 1947 in Trivandrum with a network of fourteen other radio-sonde stations distributed all over India.

Radio-sonde is the latest development in meteorological science for the determination of temperature, pressure and humidity of upper atmosphere.

The technique was entirely worked out by the officers of the India Meteorological Department during the last five years, and incorporates many new and ingenious devices, rendering the instrument accurate and reliable and easy of construction, reproduction, installation and operation. The method consists of sending up four-metre wireless transmitters attached to a balloon which sends out regularly signals of pressure, temperature and humidity. These signals are picked up by specially constructed receivers and are recorded on moving paper tape. From these records, the pressure temperature and humidity of air over Trivandrum at various altitudes are calculated.

The data obtained daily are expected to yield

valuable information regarding mechanism of monsoons and, in conjunction with those from fourteen other stations in India, it provides valuable aid to weather prophets at several centres of meteorological offices.

Until recently, before the introduction of radio method, balloons with self-recording instruments were used by the Department for the same purpose.

But, since the success of each flight depends on the chance recovery of the instrument after it falls to the earth, those flights were only of limited use for daily forecasting work. Radio-sonde helps obtain meteorological data at different stations at the same hour, and thus places the science of weather forecasting on a surer basis. The Indian Meteorological Department itself manufactures every part of these instruments, calibrates them, and arranges to send them to different radio-sonde stations set up and run by them.

SNOW SURVEY IN THE HIMALAYAS

The presence of abundant snow water along the high crests of the Himalayas and even at much lower elevations of about 10,000 ft. above the sea level, had been proved. On May 20, the American expert, Dr. J. E. Church, at the Royal Asiatic Society of Bengal, related his experiences of the four expeditions in Sikkim and Nepal that he has carried out during the present spring. Dr. Church added that below that elevation, rivers depended almost wholly upon rains.

Dr. Church who has been invited by the Government of India to lay out a snow survey system in the Himalayas, is Chairman of the International Commission for Snow Survey, U.S.A. He is well known as the originator of the percentage forecast scheme by which the run-off of streams can be estimated in advance directly from the snow fields at the lower elevations. This helps in making a forecast of the volume of water in the great store of snow on high peaks.

The expeditions of Dr. Church this spring in the Sikkim and Nepal regions were in connection with the proposed Kosi and Teesta Dams.

SOVIET EXPEDITION TO THE ARCTIC

The Soviet Union is reported to be planning to sail the first big passenger and transport ships in Arctic waters.

A large air expedition will leave next month to study ice formation in the area and some 200 staff workers of the Arctic Research Institute will work in the Arctic meteorological stations and supply information about ice conditions to ships sailing along the northern routes.

SOVIET FISHING EXPEDITION

A scientific expedition to conduct research into the fishing resources of the seas of Okhotsk and Japan left Leningrad for Sakhalin and the Kurile Islands.

The expedition has four ships at its disposal and it is intended to send at least fifteen parties to various places in this immense area.

TRAINING OF INDIAN STUDENTS ABROAD —SCOPE IN EUROPEAN UNIVERSITIES

Efforts are being made for the higher training of Indian students all over Europe, and, according to latest information, fresh openings for these students are becoming available in most of the European capitals.

Mr. P. N. Kripal, Education Liaison Officer of the Government of India, who has just returned to London from Switzerland, told the United Press of India to-day that he succeeded in obtaining a large number of places in the Swiss Federal Institute of Technology, the Zurich University, and in the College of Engineering, Lausanne. It is expected that some forty to fifty Indian students will be accommodated in the ensuing year.

Mr. Kripal also had good response to his enquiries from Holland, Belgium, Sweden, Czechoslovakia and France. All these countries are said to be very keen on welcoming students from India. In view of the prevailing difficulties of accommodation in London, Mr. Kripal thinks that Indian students would be well advised to attend the continental colleges and try to acquire a rudimentary knowledge of their languages.

VANASPATHI RESEARCH

Two research schemes on Vanaspathi have been sanctioned by the Central Food Department, one to determine the nutritive value of Vanaspathi, and the other to determine its effect on human beings.

Research on the first will be conducted at the Indian Institute of Science, Bangalore, and the University College of Science at Calcutta, and research on the second will be carried out at Bombay, Delhi and Mysore or Madras.

Another research scheme sanctioned is in connection with a plant for the manufacture of soya bean milk.

LAUNDRY RESEARCH

New researches in laundering are reported to revolutionise the current methods of laundering. It has been found that dirt is often held to a fabric by electrical attraction. The problem in the removal of dirt from fabrics is to break this electrical attraction; this is done at present by the use of detergents—soap and kindred solutions.

The British Launderers' Research Association is now researching on the use of supersonic vibrations to speed up laundry processes. The function of these supersonic vibrations is to shake out the dirt particles, and emulsify them in the cleansing solution. This will prevent the dirt being deposited again on the fabric.

MACHINE DESTROYS WEEVILS BY DIZZINESS

A Sydney flour milling firm has installed a new machine which cleans flour by spinning weevils or any other insects in the flour to death.

The machine, called an "Entoletor", operates on the centrifugal principle. The flour is fed by chutes into a cabinet housing a conical rotor in the centre of two steel discs joined at the outside by metal studs. Directed on to the revolving rotor, the flour is flung against the

outer studs with such force that no insect, weevil, moth, egg or mite, is left alive. The rotor spins at 2,900 revolutions a minute and a $1\frac{1}{2}$ horse-power machine handles 2,000 lbs. of flour an hour. The 3 h.p. model handles 5,000 lbs. of flour; the 5 h.p. 10,000 lbs., and the $7\frac{1}{2}$ h.p. 15,000 lbs. an hour.

When treated in this way the flour remains sterilised indefinitely and tests have shown that the machine improves the flour by giving it greater aerating qualities.

STEPS TO EXPAND DAIRY TRAINING

The Government of India have appointed an *ad hoc* Committee to study the facilities now available for training in dairying in India, and make recommendation for expansion.

The Committee consists of Sir Datar Singh as Chairman, and the following members:—Mr. Zal R. Kothavala, Dairy Development Adviser to the Government of India, Mr. A. K. Yegna Narayan Aiyer, Retired Director of Agriculture in Mysore, and Dr. Sen, Director of Dairy Research, Bangalore.

CENTRAL GOVERNMENT TO START AN AGRICULTURAL COLLEGE

Detailed plans have now been worked out to start a Central College of Agriculture in Delhi during the current year. The aim of the College will be two-fold, to give a systematic course of scientific agriculture to young men, with a view to preparing them for promoting modern agriculture in the countryside on economic lines, and to train students for undertaking research in agricultural problems.

NEW MEDICAL COLLEGE FOR CALCUTTA

Calcutta will soon have an up-to-date medical college devised to train demobilised licentiate I.A.M.C. Officers for the M.B. and B.S. Degree and a hospital with several divisions, each of which will have its own out-patient department, laboratory, dispensary and wards. The Health Department of the Government of India is establishing this Institution on the Dhakuria Lake site in South Calcutta.

The Central Government have already spent Rs. 85 lakhs for acquiring the site and the equipment for the College and Hospital. The annual recurring expenditure on the College will be Rs. 4.8 lakhs and on the Hospital Rs. 22 lakhs, half of which will be borne by the Bengal Government to whom the management of the College and Hospital has been entrusted.

COLLEGE OF INDIAN MEDICINE

The Madras Government has decided to convert the present School of Indian Medicine, Madras, into a College of Indian Medicine with effect from July 1947.

Arrangements would, however, be made by the Government for the continuance of the stu-

dies of those students who are already in the School till their courses are completed.

SOVIET HONOUR FOR SIR C. V. RAMAN

Sir C. V. Raman, President of the Indian Academy of Sciences, has been elected as a corresponding member of the Soviet Academy of Sciences.

NATIONAL INSTITUTE OF SCIENCES

The Academy of Sciences of the U.S.S.R. has presented to the National Institute of Sciences of India 44 books on scientific subjects and 67 copies of journals published by the Academy. The National Institute of Sciences of India has gratefully accepted this welcome gift from a sister scientific body.

LADY TATA MEMORIAL TRUST

(Scholarships and Grants for the year 1947-48)

The International awards of the Trust for research in diseases of the blood with special reference to Leucæmias are made to Doctors Jorgen Bichel (Denmark), Pierre Cazal (France), Pierre Dustin (Belgium), Maurice Guerin (France), Simon Iversen (Denmark), Joseph Japa (Poland), Edith Paterson (Great Britain), Edoardo Storti (Italy), Peter A. Goror (England), Johannes Clemmesen (Denmark), C. F. M. Plum (Denmark), Tage Kemp (Denmark), and Guido Totterman (Finland).

Indian scholarships of Rs. 250 per month each for one year for scientific investigations having a bearing on the alleviation of human suffering are awarded to Messrs. Suprabhat Mukerjee (Calcutta), Haridas Brahmachari (Nagpur), Kalyanmoy Mukerjee (Calcutta), Naresh Chandra Ghosh (Calcutta), P. R. Gupta (Bangalore) and Yeshwant Balkrishna Rangnekar (Bangalore).

A REQUEST

"Those interested in 'problems of theory of numbers especially Diophantische are requested to send their publications to the following address:—Dr. Alfred Moessner, in 13 a, Gunzenhausen (Germany-Bayern), Altes Schulhaus, Amerikanische Zone."

ERRATA

Note entitled "Vernalisation Response of Cultivated Indian Wheat", Vol. 15, No. 12, p. 352: In the names of authors, read Pal for Paul.

Vol. 16 No. 4, p. 133.—Note on "Proof of the Inverse Square Law and the Measurement of H". Line 8:

for:

$$\tan^2 \theta_A \tan^{3/2} \phi_B = 2,$$

read:

$$\frac{\tan^2 \phi_A}{\tan^{3/2} \phi_B} = 2$$

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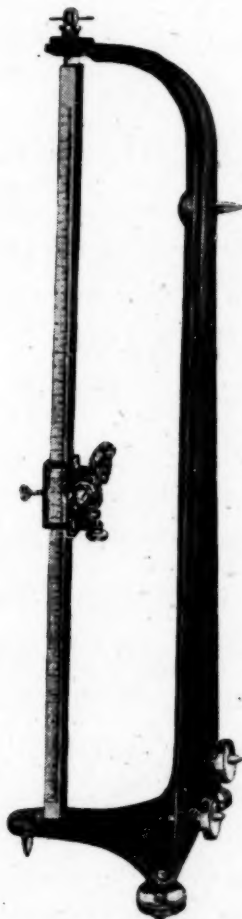
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